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PHASE II WORK PLAN FOR INDOOR AIR SAMPLING AND MITIGATION

DELPHI VOC PLUME SITE

DELPHI AUTOMOTIVE HOLDINGS GROUP
HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

U.S. EPA ID # OHD000817023

by

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1. BACKGROUND

1.1 Introduction

This Work Plan provides the scope of activities for Phase II indoor air sampling and potential mitigation being conducted as part of Delphi Corporation's ongoing environmental investigation activities associated with the Delphi VOC Plume Site.

This Phase II Work Plan has been developed pursuant to an Administrative Order on Consent ("Order") between U.S. EPA and Delphi Corporation, effective 6 November 2007, to address volatile organic compounds (VOCs) detected in soil vapor in the vicinity of the Delphi Automotive Holdings Group Home Avenue Operations (the "Facility") located at 2701 Home Avenue in Dayton, Montgomery County, Ohio (Figure 1).

To date, Delphi has investigated and characterized subsurface conditions beneath its property and in the surrounding area. Samples of soil, groundwater and soil vapor have been analyzed to determine where VOCs are present and at what levels. Delphi has installed and currently operates a Soil Vapor Extraction (SVE) system in proximity to those apparent source areas at the Home Avenue Facility to remove VOCs from the subsurface. The system has been operating since March 2006 and its performance is routinely monitored.

As Delphi has become aware of the potential for migration of VOCs in soil vapor offsite, it has expanded its investigations into the surrounding area. Pursuant to the Order, Delphi has initiated implementation of its Phase I Work Plan, approved by U.S. EPA on 6 November 2007. The Phase I Work Plan includes quarterly indoor air monitoring in five (5) homes, and installation of mitigation systems and performance monitoring in each of five (5) homes in the vicinity of the Facility. Additional information may be found at the U.S. EPA On-Scene Coordinator website for this project (www.epaosc.net/delphivocsite).

1.2 Site History

The Facility is located in a mixed industrial, residential and commercial area in southwest Dayton. The Facility was developed by General Motors Corporation (GM) in 1918 and has continuously operated as an automobile parts manufacturing, shipping and warehouse facility to the present. In January 1999, Delphi Automotive Systems separated from GM to form a new company. Later the company was renamed Delphi Corporation, with the Facility operating under the Delphi Energy & Chassis (E&C) Systems Division. The Facility currently operates under the Delphi Automotive Holdings Group (DAHG) of Delphi Corporation.

Delphi has performed investigations at its Home Avenue Facility and in right-of-ways in neighboring residential areas. The investigations were conducted in five phases between February 2005 and May 2007 and included installation of thirty-five (35) permanent soil vapor monitoring points, forty (40) temporary soil vapor monitoring points, sixty-five (65) soil borings and ten (10) monitoring wells. These investigations also included collection of sixteen (16) indoor air samples, fourteen (14) outdoor air samples, fifteen (15) sub-slab air samples and fifteen (15) near slab air samples. A total of one hundred sixty-eight (168) soil vapor samples, one hundred seventy-two (172) soil samples, thirty (30) ambient air samples and thirty-five (35) groundwater samples (11 from wells and 24 from soil borings) were collected during the

investigations and analyzed for VOCs. A summary of the environmental investigation data was provided to the U.S. EPA in June 2007.

1.3 Approach

The results of both onsite (the Facility property) and offsite (in the vicinity of the Facility) soil vapor investigations conducted to date for the Delphi Home Avenue Facility indicate tetrachloroethene (PCE), trichloroethene (TCE) and chloroform are present in soil vapor at the Facility and offsite in the vicinity of the Facility. These constituents are referred to herein as the constituents of concern.

The Ohio Department of Health (ODH) has established the screening levels used in evaluation of indoor air and sub-slab data collected pursuant to the Order. According to the U.S. EPA and ODH, the indoor air and sub-slab soil vapor screening levels established for this project are consistent with the screening levels established for U.S. EPA investigations performed at other sites in Ohio. The screening levels for TCE, PCE and chloroform in residential indoor air and sub-slab soil vapor are included in the Order, and are presented in Section 4 of this Work Plan. They are herein referred to as the "ODH-recommended screening levels" for indoor air and sub-slab soil vapor.

The work scope for the Phase II indoor air investigation was developed by identifying trends in the occurrence of VOCs in soil vapor and indoor air detected in the Phase I sampling program, and using these trends as a guide for further investigation. Figure 2 summarizes the results of the Phase I indoor air sampling and mitigation program and illustrates the location of structures that are included in the Phase II study area.

During Phase I five (5) structures were determined to require no further action, as no constituents of concern were present above any of the ODH-recommended screening levels for this project.

Structures shaded in green on Figure 2 are included in the Phase I quarterly monitoring program. These are structures where the results of the Phase I sampling program found no constituents of concern at levels exceeding the OHD-recommended residential indoor air screening levels; however, ODH-recommended sub-slab soil vapor screening criteria were exceeded for at least one constituent. Five (5) structures are included in the Phase I quarterly sampling program. To date, two sampling events have been performed at these structures. Additional Phase I quarterly sampling events are roughly scheduled for February and May 2008 at these locations.

Structures shaded in orange are structures where mitigation systems have been installed. These are structures where Phase I sampling results indicated at least one constituent of concern exceeded the ODH-recommended residential indoor air and sub-slab soil vapor screening level. Five (5) structures are included in the Phase I mitigation monitoring program.

Figure 2 illustrates the scope of the Phase II investigation area, which includes twenty-eight (28) structures (shaded in purple). These structures include eight (8) structures that were included in Phase I, for which no response was received from the property owner, or the structure was potentially uninhabitable during that sampling event. Structures verified as uninhabitable by the City of Dayton Department of Building Services will not be sampled.

2. SITE MOBILIZATION

2.1 Site Safety

A Health and Safety Plan (HASP) has been developed for this project and was approved by U.S. EPA as part of the Phase I Work Plan. The HASP establishes the procedures for protecting personnel and subcontractors during the sampling, monitoring and mitigation activities addressed in this Work Plan.

The HASP is based on the data collected at the Facility and the surrounding area, and includes security procedures developed in collaboration with the Dayton Police Department and the Southwest Priority Board to assure the security and comfort of property owners, residents, personnel and subcontractors during sampling and mitigation activities. A copy of the approved HASP is included as Appendix A to this Work Plan.

The HASP will be updated as necessary, as information is collected that warrants its revision.

2.2 Meetings

Delphi routinely meets with representatives of the U.S. EPA, the Ohio EPA, the Ohio Department of Health, Public Health – Dayton & Montgomery County and the City of Dayton to review the work being completed pursuant to the approved Phase I Work Plan. As described in Section 8.3 of this Work Plan, Delphi will continue to meet with representatives of these agencies to discuss development and implementation of the Phase II work scope. Additionally, Delphi will meet with representatives of the Southwest Priority Board, the Dayton Police Department and other agencies, as appropriate, to discuss progress in the on-going environmental studies and to collaborate on development and implementation of communication and security strategies.

3. SAMPLING ACTIVITIES

The scope of the indoor air sampling program included in this Phase II Work Plan consists of employing best efforts to perform indoor air and sub-slab soil vapor sampling at the structures identified in Table 1. For each structure sampled, one soil vapor sample will be collected from immediately below the structure's slab (i.e. sub-slab), and one indoor air sample will be collected from the basement or first floor of living space. Where a structure is constructed with a crawl space and no basement, one air sample will be collected from the crawl space and the first floor of living space. These samples will constitute the initial, or baseline sampling event for the structure.

Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g. framed drywall, masonry), one indoor air sample will be collected from each segregated basement area. Additionally, as part of this sampling program, outdoor ambient air background samples may be collected upwind in the vicinity of the sampled structure. The Standard Operating Procedures (SOPs) for collection of sub-slab soil vapor samples, indoor air samples and outdoor ambient air samples were approved by the U.S. EPA in the Phase I Work Plan and are included as Appendix C of this Phase II Work Plan.

Upon U.S. EPA's approval of this Phase II Work Plan, sampling appointments will be scheduled with the owner of each of the structures for which Delphi has been granted written permission by the homeowner, or the homeowner's representative, to sample.

Prior to sampling, Delphi will collect information pertaining to the construction of the structure and household activities by completing a questionnaire with each property owner who grants permission to sample, and their tenants, as needed. The questionnaire will also be used to document any household products observed in the vicinity of the areas sampled during the sampling event. The questionnaire is included as an Appendix D to this Work Plan.

Structures to be sampled in this phase of the sampling program exclude buildings which have been determined to be uninhabitable (e.g., condemned, windows and doors boarded, dilapidated condition) at the time of the initial sampling event. Delphi will attempt to verify the occupancy status of such structures with the City of Dayton Department of Building Services.

The scope of the initial sampling event at a structure includes the following:

- Collection and analysis of one soil vapor sample from beneath the structure's slab, if present;
- Collection and analysis of one indoor air sample collected in the basement;
- Collection and analysis of one air sample from the crawl space or first floor of living space where no basement is present;
- Collection of information pertaining to the construction of the structures and any household products located in proximity to the indoor air sampling point.

Specific guidance utilized in the preparation of this Work Plan was provided by the U.S. EPA, Office of Solid Waste and Emergency Response, *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) EPA 530-D-02-004 (November 2002)*. An additional resource for creating

this Work Plan was *Generic Work Plan Outline and Site Safety Plan for Potentially Responsible Parties (PRPs)* (Ecology and Environment, Inc. Technical Assistance Team June 1992), provided to Delphi by the U.S. EPA.

Samples collected during this phase of the sampling program will be submitted to Columbia Analytical Services for analysis of VOCs by EPA Test Method T0-15. Evaluation of soil vapor and air sample data collected during this phase of the sampling program will be conducted following the approach described in Section 4 of this Work Plan.

Should an indoor air sample result in the detection of any of the constituents of concern at a level that exceeds the respective ODH-recommended indoor air screening level, and the evaluation of that data indicates vapor intrusion, rather than ambient air or indoor sources, is the sole or predominant source of the exceedance, mitigation measures will be employed as described in Section 6.

3.1 Access for Sampling

Delphi has developed and implemented multi-faceted community outreach strategies to keep stakeholders informed of the activities associated with its ongoing environmental investigations. These strategies have included written correspondence with residents and property owners, phone calls, face-to-face meetings with property owners and other stakeholders, and distribution of Ohio Department of Health Fact Sheets, examples of which are include in Appendix E of this Work Plan. Additionally, Delphi has established a toll-free centralized information hotline (1-866-4DELPHI) to facilitate communication between Delphi and its stakeholders. This telephone number is included in all correspondence from Delphi.

Delphi's best efforts to gain access to properties for purposes of collecting samples will include the following:

- Delphi will send by certified mail a letter requesting permission to sample. An access agreement will be included with the letter, as will copies of ODH Fact Sheets for each of the constituents of concern and routes of chemical exposure.
- If the property owner does not return the signed access agreement, a second certified letter will be sent. The second letter will request permission to sample and will include a declination form to be returned by the property owner if he or she is not agreeable to participating in the sampling program. The second letter will inform the addressee that Delphi assumes no response received within thirty (30) days indicates desire not to participate in the sampling program, and no further attempts to contact the property owner will be made by Delphi.

Only structures for which Delphi has been granted written permission by the property owner will be included in the sampling program. The U.S. EPA will be informed of structures for which no response has been received from the property owner of record, or for which access is denied. It is Delphi's understanding that the U.S. EPA may attempt to contact non-responsive owners of structures located in the Phase II study area for purposes of requesting permission to sample their structures. This information will be included in the air sampling and mitigation program summary report.

Examples of the public outreach documents and access agreements employed in this phase of the sampling program are included as Appendix E to this Work Plan.

3.2 Sub-Slab Soil Vapor Sampling

One temporary or permanent soil vapor sampling point will be installed beneath the basement slab or the first floor slab, if no basement is present, within the structure. If sub-slab sampling cannot be performed without causing significant disturbance (e.g., damaging carpet, or wood or ceramic floors) to the building, or the property owner refuses to allow sub-slab sampling, a soil vapor sampling point will not be installed beneath the slab.

The location of the sub-slab sampling point will be determined based upon building construction, foundation type and information concerning utilities. The SOP for installation of sub-slab soil vapor points for this project has been provided by the U.S. EPA and is included as Appendix B of this Work Plan. The sampling point will be installed through the slab several inches into the sub-slab material, consistent with the SOP. The sampling point will be appropriately sealed to prevent the infiltration of indoor air. The sub-slab soil vapor sample will be collected using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period.

The SUMMA® canisters and flow controllers used to collect the sub-slab soil vapor samples will be obtained from Columbia Analytical Services. The SUMMA® canister final vacuum will be recorded to confirm the sample remains intact during transit to the laboratory. Canister vacuum will be recorded on a chain of custody (COC) form before shipping to the analytical laboratory and upon arrival will be used by the laboratory to verify sample integrity.

The sub-slab soil vapor samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and laboratory control sample (LCS) analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the U.S. EPA-approved Phase I QAPP.

3.3 Indoor Air Sampling

One indoor air sample will be collected from the basement of each structure or from the first floor living space if no basement is present. Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g., framed drywall, masonry), an indoor air sample will be collected from each basement area. For locations constructed with a crawl space but no basement, one indoor air sample will be collected from both the crawl space and the first floor of living space. Location of the sampling point in each structure will be selected depending upon the construction and features of the building (e.g., dirt floors, sumps) and location of household products.

The indoor air sampling will be performed concurrently with any sub-slab soil vapor sampling conducted at that structure. The structure's heating and cooling systems will remain in their normal operating status (e.g., the occupant's normal settings) during the sampling event. Delphi will request of property owners and tenants that vents discharging to the area of indoor air sampling be closed approximately 24 hours prior to the sampling event and remain closed during the sampling period. The status of vent closure will be documented in field notes.

Additionally, Delphi will encourage the structure's residents to restrict access to the area being sampled.

The SUMMA® canister used to collect the indoor air sample will be placed on a table, bench or similar structure, roughly 2 to 4 feet above floor level, to approximate the breathing zone with respect to assessing indoor air. The indoor air sample will be collected using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period. The SOP for collection of indoor air samples is provided as Appendix C of this Work Plan.

The SUMMA® canisters and flow controllers used to collect the indoor air samples will be obtained from Columbia Analytical Services. The SUMMA® canister final vacuum will be recorded to confirm the sample remains intact during transit to the laboratory. Canister vacuum will be recorded on a chain of custody (COC) form before shipping to the analytical laboratory and upon arrival will be used by the laboratory to verify sample integrity.

The indoor air samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and LCS analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the approved Phase I QAPP, included as Appendix I in the Phase I Work Plan.

A photoionization detector (PID) will be used to perform an indoor ambient air screening prior to the initiation of the indoor air sampling event. The PID will be used to identify potential sources of VOCs within the structure and assist in the placing of the SUMMA® canister. Additionally, prior to the initiation of indoor air sampling activities, Delphi will document information relevant to identifying potential VOC sources from interior materials (e.g., construction materials, cleaning products) that may impact the sample analysis. Although Delphi will have no control over activities conducted in the structure throughout the sampling duration, to the extent possible, Delphi will containerize or remove from the sampling area any potential VOC sources that could contribute to analytical interference.

3.4 Background Ambient Air Sampling

One outdoor ambient air background sample may be collected concurrently with the sub-slab soil vapor and indoor air sampling event at or near that structure. The outdoor ambient air sample will be collected upwind in the vicinity of the structure, based on prevailing wind directions, using a batch certified 6-Liter SUMMA® canister equipped with an integrated flow controller over a 24-hour period. Delphi will not have control over the sampling device during the duration of the 24-hour sampling period; therefore, Delphi will attempt to assure custody of the canisters by securing them with steel cables and padlocks. The SOP for collection of air samples is provided in Appendix C to this Work Plan.

The SUMMA® canisters and flow controllers used to collect the outdoor ambient air samples will be obtained from Columbia Analytical Services. The SUMMA® canister final vacuum will be recorded to confirm the sample remains intact during transit to the laboratory. Canister vacuum will be recorded on a chain of custody (COC) form before shipping to the analytical laboratory and upon arrival will be used by the laboratory to verify sample integrity.

The outdoor ambient air samples will be shipped at ambient temperature under the COC to Columbia Analytical Services for analysis of VOCs using EPA Method TO-15. Laboratory quality control samples will include method blank and LCS analyses. The laboratory SOP for the analysis of VOCs by U.S. EPA Method TO-15 is included as an attachment to the approved Phase I QAPP.

3.5 Sample Analysis

Soil vapor and air samples will be analyzed by EPA Method TO-15 to achieve, as technically possible, the following method detection limits (MDLs) for each of the constituents of concern:

Chemical Name	Method Detection Limit (part per billion by volume of air)
TCE	0.18
PCE	0.15
Chloroform	0.20

Actual reporting limits may vary and could be higher based on the presence of VOCs within the structures associated with the activities over which Delphi has no control. Such conditions could require dilution of samples and corresponding elevated reporting limits for the target VOC. If the final reporting limit achieved by the laboratory is greater than the screening level for a constituent of concern, and all constituents of concerns are reported as below the detection limit, re-sampling will be performed at the relevant structure.

3.6 Quality Assurance Project Plan

Quality control samples will be analyzed by the laboratory (e.g., method blanks, laboratory control samples) in accordance with the approved Phase I QAPP.

3.7 Indoor Air Sampling Reporting

Once validated, data collected during the Phase II sampling activities will be reported within approximately thirty (30) days to the U.S. EPA, ODH, PHDMC and the owner of the structure sampled.

4. DATA EVALUATION

The conservative indoor air and sub-slab soil vapor ODH-recommended screening levels for this project are as follows:

Indoor Air and Sub-slab Soil Vapor ODH-recommended Screening Levels[1] for VOCs in Residential Structures (parts per billion by volume)			
Chemical Name	ATSDR[2] Indoor Air Short-Term Action Level	Indoor Air Long-Term Screening Level[1]	Sub-Slab Soil Vapor Screening Level[1]
TCE	100	0.4	4
PCE	200	12	120
Chloroform	50	2.2	22
1. Established in correspondence from Ohio Department of Health (June 4, 2007) 2. ATSDR = Agency for Toxic Substances Disease Registry			

The following presents the data evaluation decision process for Phase II:

- Where indoor air results are below the ODH-recommended indoor air screening levels, and sub-slab soil vapor results are above the ODH-recommended sub-slab soil vapor screening levels, the structure will be included in the quarterly monitoring program described herein.
- Where indoor air results are above the ODH-recommended indoor air screening levels, and sub-slab soil vapor results are above the ODH-recommended sub-slab soil vapor screening levels, mitigation is warranted.
- Where indoor air results are below the ODH-recommended indoor air screening levels, and sub-slab soil vapor results are below the ODH-recommended sub-slab soil vapor screening levels, no further action is warranted.
- Where indoor air results are above the ODH-recommended indoor air screening levels, and sub-slab soil vapor results are below the ODH-recommended sub-slab soil vapor screening levels, it is presumed that a source other than soil vapor has contributed to the indoor air sample exceedance, and mitigation may not be warranted.
- Where a crawl space sample has been collected and data is above the ODH-recommended indoor air screening levels, and the indoor air sample collected from the first floor of living space is below those screening levels, the structure will be included in the quarterly monitoring program.

4.1 Evaluation of Sub-Slab and Indoor Air Data

As described in Section 3, the quarterly indoor air sampling program will generate indoor air data, sub-slab soil vapor data, and ambient background air data. After these data are reported by the analytical laboratory, and Haley & Aldrich has validated the data, Delphi and the U.S. EPA will evaluate the data to make decisions regarding the need for further action. In addition to comparison of the data with the established indoor air and sub-slab ODH-recommended screening levels, the data evaluation will include the following:

- Comparison of soil vapor and indoor air data with ambient background concentrations;
- Comparison of indoor air data with sub-slab soil vapor data;

- Comparison of indoor air data with reasonably expected indoor air concentrations for other known or suspected in-home sources (e.g., trihalomethanes [THMs], including chloroform that can be a by-product of drinking water purification processes).

The conclusion that mitigation is warranted at a structure included in the quarterly monitoring program presumes that the sampling data indicates that vapor intrusion, rather than ambient air or indoor sources, is the sole or predominant source of the VOCs detected above the ODH-recommended screening levels in the indoor air sample.

Should evaluation of data collected through implementation of the Phase II Work Plan indicate the need to expand the Phase II sampling program to additional structures in the vicinity of the Home Avenue Facility, that work would be addressed in a subsequent work plan.

5. QUARTERLY MONITORING

Subject to the data evaluation and presumptions stated in Section 4 of this Work Plan, where TCE, PCE and/or chloroform are detected in baseline sub-slab soil vapor samples at levels exceeding the ODH-recommended soil vapor screening levels, a program of quarterly sampling will be employed. A program of quarterly sampling will also be implemented in the event a crawl space air sample shows detection of one or more constituents of concern at a level exceeding the OHD-recommended indoor air screening levels and the sample collected from the first floor of living space of that structure is below those screening levels.

The scope of the quarterly monitoring program will be consistent with the work scope for quarterly monitoring presented in the approved Phase I Work Plan. For each quarterly monitoring event performed at a structure, one sub-slab soil vapor sample will be collected from immediately below the structure's slab. Additionally, one air sample will be collected from the basement, crawl space or first floor living space of each structure.

Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g. framed drywall, masonry), one indoor air sample will be collected from each basement area. Additionally, as part of this sampling program, outdoor ambient air background samples may be collected upwind in the vicinity of the sampled structure. The Standard Operating Procedures (SOPs) for collection of sub-slab soil vapor samples, indoor air samples and outdoor ambient air samples approved by the U.S. EPA in the Phase I Work Plan will be followed in implementation of this Phase II sampling program and are included as Appendix C to this Work Plan.

Where quarterly monitoring is required, best efforts to establish a schedule of quarterly monitoring will be initiated within thirty (30) days of receiving the validated data from the baseline sampling event. The baseline sampling events performed by Delphi at these structures will constitute the first round of quarterly monitoring for these locations. Quarterly monitoring will be complete when four consecutive rounds of sub-slab soil vapor results are below the ODH-recommended soil vapor screening levels. For those structures constructed with a crawl space and included in the quarterly monitoring program, quarterly sampling will conclude when four consecutive rounds of sampling have demonstrated no constituents of concern exceeding the OHD-recommended indoor air screening levels in the samples collected from the first floor of living space.

Should a quarterly monitoring event result in the detection of any of the constituents of concern in indoor air at a level that exceeds the respective ODH-recommended indoor air screening level, and the evaluation of that data indicates that vapor intrusion, rather than ambient air or indoor sources, is the sole or predominant source of exceedance, mitigation measures will be employed as described in Section 6.

During the quarterly sampling events, Delphi will document any changes to the structure that have occurred since the previous sampling event performed at that address. Additionally, prior to the initiation of indoor air sampling activities, Delphi will document information relevant to identifying potential VOC sources from interior materials (e.g., construction materials, cleaning products) that may impact the sample analysis. Although Delphi will have no control over activities conducted in the structure throughout the sampling duration, to the extent possible,

Delphi will containerize or remove from the sampling area any potential VOC sources that could contribute to analytical interference.

Structures to be sampled in this phase of the sampling program exclude buildings which have been determined to be uninhabitable (e.g., condemned, windows and doors boarded, dilapidated condition) at the time of the quarterly sampling event. Delphi will attempt to verify the occupancy status of such structures the City of Dayton Department of Building Services.

The scope of the quarterly monitoring program covered by this Work Plan includes for each quarterly event:

- Collection and analysis of one sub-slab soil vapor from beneath the structure;
- Collection and analysis of at least one indoor air sample per structure, from the basement or first floor of living space if no basement is present;
- Collection and analysis of one crawl space indoor air sample if present at a structure without a basement;
- Updating the structure's questionnaire and documenting observations (e.g. household products, operation of HVAC systems) made during the sampling event.

Soil vapor and indoor air samples will be submitted to Columbia Analytical Services for analysis of VOCs by EPA Test Method T0-15. Evaluation of soil vapor and air sampling data collected during this phase of the sampling program will be conducted following the approach described in Section 4 of this Work Plan.

5.1 Access for Quarterly Indoor Air Sampling

Delphi will exercise the following measures as best efforts to gain access to properties for purposes of quarterly monitoring:

- Delphi will contact the owners of properties sampled to schedule a face-to-face meeting. The meetings will be conducted individually with property owners. Representatives of the U.S. EPA, Ohio Department of Health and/or Public Health – Dayton & Montgomery County will be invited to attend. During the meeting, Delphi will explain why quarterly sampling is prudent, how the samples will be collected, and the anticipated schedule of sampling. Delphi will inform each of these property owners of the requirement to execute a signed access agreement before quarterly monitoring can begin.
- If the property owner is not agreeable to a face-to-face meeting or cannot be reached by phone, Delphi will mail the information to that property owner by certified mail. After approximately one week, Delphi's community relations representative will attempt to follow up (via phone call or door hanger, if necessary) with the property owner, with whom Delphi was unable to meet, to determine whether that owner is agreeable to participation in the quarterly monitoring program.
- Should a property owner decline to participate in the quarterly monitoring program, Delphi will request the property owner's signature of declination.

The U.S. EPA will be informed of structures for which no response is received from the property owner of record, or for which access is denied. It is Delphi's understanding that the U.S. EPA may attempt to contact non-responsive owners of structures included in the Phase II

quarterly sampling program for purposes of requesting permission to sample their structures. This information will be included in the air sampling and mitigation summary report.

Authorization through a signed access agreement with the property owner must be obtained by Delphi before Delphi can begin quarterly monitoring. Examples of the public outreach documents and access agreements employed in this phase of the sampling program are included in Appendix E of this Work Plan.

5.2 Sub-Slab Soil Vapor Sampling

One permanent soil vapor sampling point will be installed beneath the basement slab or the first floor slab, if no basement is present, within the structure. If sub-slab sampling cannot be performed without causing significant disturbance (e.g., damaging carpet, or wood or ceramic floors) to the building, or the property owner refuses to allow sub-slab sampling, a soil vapor sampling point will not be installed beneath the slab.

The location of the sub-slab sampling point will be determined based upon building construction, foundation type and information concerning utilities. The sampling point will be installed through the slab to a depth of several inches into the sub-slab material. The sampling point will be appropriately sealed to prevent the infiltration of indoor air. The sub-slab soil vapor sample will be collected using the methods described in Section 3.2 of this Work Plan and in accordance with the SOP for installation of the sub-slab soil vapor points provided by the U.S. EPA and included as Appendix B of this Work Plan.

5.3 Indoor Air Sampling

One indoor air sample will be collected from the basement of each structure or from the first floor living space if no basement is present. Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g., framed drywall, masonry), an indoor air sample will be collected from each basement area. Location of the sampling point in each structure will be selected depending upon the construction and features of the building (e.g., dirt floors, sumps) and location of household products.

The indoor air sampling will be performed concurrently with sub-slab soil vapor sampling being conducted at that structure. The structure's heating and cooling systems will remain in their normal operating status (e.g., the occupant's normal settings) during the sampling event. Delphi will request of property owners and tenants that vents discharging to the area of indoor air sampling be closed approximately 24 hours prior to the sampling event and remain closed during the sampling period. The status of vent closure will be documented in field notes. Additionally, Delphi will encourage the structure's residents to restrict access to the area being sampled.

Indoor air sampling will be performed using the methods described in Section 3.3 of this Work Plan and in accordance with the SOP for indoor air sampling included as Appendix C of this Work Plan.

5.4 Background Ambient Air Sampling

One outdoor ambient air background sample may be collected concurrently with the sub-slab soil vapor and indoor air sampling event at that structure. The background ambient air sample will be collected using the methods described in Section 3.4 of this Work Plan and in accordance with the SOP for ambient air sampling included as Appendix C of this Work Plan.

5.5 Sample Analysis

Soil vapor and air samples will be analyzed by EPA Method TO-15 to achieve as technically possible, the MDLs specified in Section 3.5 of this Work Plan.

5.6 Quality Assurance Project Plan

Quality control samples will be analyzed by the laboratory (e.g., method blanks, laboratory control samples), in accordance with the approved Phase I QAPP.

5.7 Quarterly Monitoring Reporting

Once validated, data collected during the quarterly monitoring events will be reported within approximately thirty (30) days to the U.S. EPA, ODH, PHDMC and the owner of the structure sampled.

6. MITIGATION

Subject to the data evaluation and presumptions stated in Section 4 of this Work Plan, where TCE, PCE and/or chloroform are detected in indoor air samples at levels exceeding the ODH-recommended indoor air screening levels, mitigation will be employed.

Mitigation could include installation of a sub-slab depressurization (SSD) system to reduce the levels of the VOCs present in indoor air. If building construction or conditions do not allow for installation of an SSD system, alternative mitigation strategies, such as impermeable membranes and/or indoor air treatment, may be considered. Installation of such alternative mitigation strategies will be subject to U.S. EPA approval.

The objective of an SSD system or alternative mitigation strategy is to reduce vapor concentrations in indoor air. Mitigation systems will be installed only in those buildings where the constituents of concern are detected at levels exceeding the ODH-recommended indoor air screening levels, and where written authorization to install and monitor the system is granted by the property owner.

Delphi will work closely with the contractors responsible for the installation of the mitigation systems to ensure proper installation and operation of the systems.

6.1 Access for Mitigation

Where mitigation activities are to be performed in areas owned by or in possession of someone other than Delphi Corporation, best efforts to obtain all necessary written access agreements to a particular property will be performed. The access agreement will address installation of the mitigation system, periodic performance monitoring and inspection of the system, and will include provisions for payment of an annual stipend to defray utility costs associated with operation of the mitigation system.

Delphi will exercise the following measures as best efforts to gain access to properties for purposes of mitigation and post mitigation monitoring:

- Delphi will contact the owners of properties sampled to schedule a face-to-face meeting. The meetings will be conducted individually with property owners. Representatives of the U.S. EPA, Ohio Department of Health and/or Public Health – Dayton & Montgomery County will be invited to attend. During the meeting, Delphi will explain why mitigation is prudent, how mitigation systems work and the mitigation system monitoring schedule. Delphi will inform each of these property owners of the requirement to execute a signed access agreement before mitigation can be employed.
- If the property owner is not agreeable to a face-to-face meeting or cannot be reached by phone, Delphi will mail the information to that property owner by certified mail. After approximately one week, Delphi's community relations representative will attempt to follow up (via phone call or door hanger, if necessary) with the property owner, with whom Delphi was unable to meet, to determine whether that owner is agreeable to installation of a mitigation system and the subsequent mitigation monitoring program.
- Should a property owner decline to participate in the mitigation program, Delphi will request the property owner's signature of declination.

The U.S. EPA will be informed of structures for which no response is received from the property owner of record, or for which access is denied. It is Delphi's understanding that the U.S. EPA may attempt to contact non-responsive owners of structures included in the Phase II mitigation program for purposes of requesting permission to abate the structures. This information will be included in the air sampling and mitigation summary report.

Authorization through a signed access agreement with the property owner must be obtained by Delphi before Delphi can install a mitigation system. Examples of the public outreach documents and access agreements employed in this phase of the sampling program are included in Appendix E of this Work Plan.

6.2 System Description

Where SSD technology is used to reduce the migration of VOCs into structures, this will be accomplished by creating lower pressure in the sub-slab as compared to the ambient indoor air space. This reduced pressure will be induced by connecting a suction fan to piping that is inserted in a suction cavity below the slab.

The SSD system exhaust standpipe will terminate at least 12 inches above the surface of the structure's roof, in a location at least 10 feet away from any window or other opening into the conditioned spaces of the structure that is less than 2 feet below the exhaust point, and at least 10 feet from any adjoining or adjacent buildings. Labels on the depressurization piping will clearly identify the purpose of the system. The suction fan will operate continuously to vent the subsurface beneath the slab.

The power supply for the fan will be locked with a padlock or other device to prevent accidental shut-off of the system. A key to the padlock will be provided to the property owner to allow for the power to be turned off for maintenance or other necessary purposes. A permanent vacuum gauge will be installed on each system on the suction side of the fan. Following start-up of the system, an initial vacuum reading will be recorded. A schematic of a typical SSD system is shown in Figure 3.

6.3 System Installation

Installation of the SSD system will be conducted by A to Z, a certified radon mitigation contractor licensed by the State of Ohio Department of Health (License Nos. RC35 and RS51), with experience in installing similar systems. The contractor will follow the methods outlined in *ASTM Standard E 2121-03 – Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings*. Prior to installing a mitigation system, Delphi and the contractor will consult with the property owner to evaluate the residence for purposes of determining the location where the installation of the SSD system will be most effective and convenient for the property owner. Based upon the onsite evaluation, the contractor will develop a structure-specific design proposal for the structure. The design proposal will include a description of the key system components, where the components will likely be installed, and alternative or contingency design considerations, to the extent technically feasible and economically reasonable.

All components of the system will be installed compliant with the applicable mechanical, electrical, building, plumbing, energy and fire prevention codes, standards and regulations of the local jurisdiction.

6.4 Operation and Maintenance

A key to the SSD system padlock and an operation and maintenance (O&M) manual will be provided to each property owner within 60 days following installation of the mitigation system.

The O&M manual will include, at a minimum, the following information:

- A description of the mitigation system and its basic operating principles;
- A description of the proper operating procedures for the system;
- The manufacturer's operation and maintenance instructions and warranties;
- Instructions for determining whether the system is operating properly;
- Photographs of system components;
- Analytical results for investigative and monitoring samples collected at that residence; and
- A list of contacts.

6.5 Mitigation Monitoring

Performance monitoring will be conducted to verify effective operation of the system. One indoor air sample and one sub-slab vapor sample will be collected from each structure in which a mitigation system is installed. Additionally, as part of the mitigation monitoring program, subsurface vacuum will be measured with a magnehelic gauge from a permanently installed sub-slab sampling point.

Where a structure consists of multiple units (e.g., duplex, triplex), and the basement is segregated by permanent wall construction (e.g. framed drywall, masonry), an indoor air sample will be collected from each basement area. The indoor air sampling and sub-slab soil vapor sampling will be performed in accordance with the sampling procedures described in Section 3 of this Work Plan and the SOPs included in Appendices B and C.

During the performance monitoring sampling events, Delphi will document any changes to the structure that have occurred since the previous sampling event performed at that address. Additionally, prior to the initiation of indoor air sampling activities, Delphi will document information relevant to identifying potential VOC sources from interior materials (e.g., construction materials, cleaning products) that may impact the sample analysis. Although Delphi will have no control over activities conducted in the structure throughout the sampling duration, to the extent possible, Delphi will containerize or remove from the sampling area any potential VOC sources that could contribute to analytical interference.

Samples will be collected while the mitigation system is operating. Additionally, the structure's heating and cooling systems will remain in the normal operating status (i.e., the occupant's normal settings). Delphi will request of property owners and tenants that vents discharging to the area of indoor air sampling be closed approximately 24 hours prior to the sampling event and remain closed during the sampling period. The status of vent closure will be documented in field notes.

Access to the property for this monitoring will be included in the access agreement for the mitigation system installation.

To verify the effectiveness of soil vapor intrusion mitigation, post mitigation system installation monitoring will occur at approximately the following intervals:

- 30 days after installation of the system;
- 60 days after installation of the system; and
- 180 days after installation of the system.

Post mitigation system installation monitoring will be performed annually following the first year of installation.

During each mitigation system monitoring event, an inspection of the system will be performed. The scope of the inspection will include:

- System vacuum/pressure readings;
- Confirmation of operation of the system fan;
- Visual inspection of system piping and components;
- Visual inspection of floor and wall seals; and
- Confirmation of operation with the property owner.

If any indoor air sample collected during the mitigation system monitoring event reveals that the system has not reduced the constituents of concern to a level below their respective ODH-recommended screening levels, a subsequent sample will be collected within 30 days. If this follow-up sample confirms concentrations are above the ODH-recommended screening levels, the mitigation system design and construction will be re-evaluated and additional engineering controls will be implemented. Recommendations for system modification, if warranted, will be provided to the U.S. EPA and implemented at the affected structure within 60 days of U.S. EPA's approval. If the follow up sample indicates concentrations are below the ODH-recommended screening levels, the established sampling schedule will resume.

6.6 Completion of Mitigation Program

Sub-slab depressurization system maintenance and mitigation performance monitoring will be discontinued when Delphi demonstrates to the U.S. EPA that sufficient reduction of soil vapor levels has been achieved in the vicinity of or beneath the related structure such that significant risk to human health no longer exists, and indoor air results for the related structure are below the ODH-recommended indoor air screening levels for the constituents of concern.

Following shutdown of any mitigation system, Delphi will exercise best efforts to implement a schedule of quarterly post-mitigation monitoring at the related structure. The post-mitigation quarterly monitoring program will consist of collection of one indoor air and one sub-slab soil vapor sample at the related structure each quarter for four consecutive quarters.

The mitigation and monitoring activities will be considered complete when four consecutive quarters of indoor air results for the related structure are below the ODH-recommended indoor air screening levels.

6.7 Mitigation Monitoring Reporting

Once validated, copies of post-mitigation system installation monitoring data will be submitted in approximately thirty (30) days to the U.S. EPA, ODH, PHDMC, and the respective property owner.

7. DATA MANAGEMENT

Copies of the validated sampling data will be submitted to the U.S. EPA, ODH, PHDMC and the respective property owner. The data management table generated for the Phase I work, and approved by U.S. EPA as part of the Phase I Work Plan will be amended to include data collected in implementation of the Phase II work described herein. An example of the data management table is included as Appendix F to this Work Plan.

Field activities will be documented and recorded on field forms, an example of which is provided as an attachment to the QAPP, which was approved by U.S. EPA as part of the Phase I Work Plan. Field forms will be utilized to document observations, measurements, and significant events that have occurred during field activities.

All laboratory reports will document sample custody, analytical chronology, analytical results, adherence to prescribed protocols, nonconformity events, corrective measures, and/or data deficiencies.

The final data deliverables will comply with the approved Phase I QAPP.

8. PROJECT MANAGEMENT

8.1 Responsibilities and Functions

The organizational structure established for management of the Phase I project will also be employed for management of the Phase II work described herein. The names, titles and telephone numbers for individuals identified in the organizational chart are provided in Figure 4 of this Work Plan.

8.2 Indoor Air Sampling and Mitigation Summary Report

Upon completion of the Phase II indoor air sampling and mitigation program, Delphi will prepare a summary report detailing the activities performed and data collected. Items to be presented in the investigation summary report include:

- Documentation of the quarterly monitoring and mitigation monitoring activities;
- Evaluation of the data generated during those activities;
- Laboratory analytical data; and
- Conclusions.

The Phase II summary report will be submitted to the U.S. EPA, ODH and PHDMC.

8.3 Progress Meetings

Progress meetings, typically in the form of weekly conference calls, will be conducted with the project technical committee to discuss the progress of implementation of the Work Plan. The frequency of these progress conference calls may be modified as the level of project activity changes.

The technical committee anticipated to participate in the weekly progress conference calls is comprised of representatives of U.S. EPA and its subcontractor, representatives of Delphi and its subcontractors, ODH and PHDMC.

Delphi will provide conference call participants the telephone number and pass code for the call, and will prepare and distribute a weekly call reminder and summaries of any laboratory data generated since the previous call. The technical committee weekly conference call agenda will be developed appropriate to the Work Plan activities being conducted at that time and may include:

- An updated spreadsheet presenting the latest validated sample data;
- Field sampling status report;
- Mitigation status report;
- Description of activities planned for the upcoming week; and
- Any project issues or problems encountered.

8.4 Schedule

Delphi commenced Phase II community outreach efforts in November 2007 and has obtained access agreements from several homeowners to perform Phase II sampling. The actual schedule of Phase II sampling and follow-up activities will be dependent upon the timeframe in which permission to access the structures is obtained from the property owners, and the results of sample analysis are received from the laboratory; however, the following timetable is planned:

- Initiation of steps to schedule sampling appointments with homeowners who have already granted Delphi permission to sample their structures will begin within thirty (30) days of receiving U.S. EPA's approval of this Phase II Work Plan.
- Following approval of this Phase II Work Plan, steps to schedule sampling appointments will be initiated within thirty (30) days of receiving a homeowner's signed access agreement.
- Initiation of steps to obtain access agreements for quarterly monitoring within thirty (30) days of completing validation of laboratory data, where sub-slab soil vapor screening criteria are exceeded for at least one constituent of concern.
- Initiation of steps to obtain access agreements for installation of mitigation systems within thirty (30) days of completing validation of laboratory data where indoor air screening criteria are exceeded for at least one constituent of concern.
- Initiation of quarterly monitoring activities within thirty (30) days of receiving an authorized access agreement from a property owner.
- Initiation of mitigation activities within (30) days of receiving an authorized access agreement from a property owner.

The U.S. EPA will be updated on the actual schedule of activities related to implementation of this Work Plan during the weekly progress meetings.

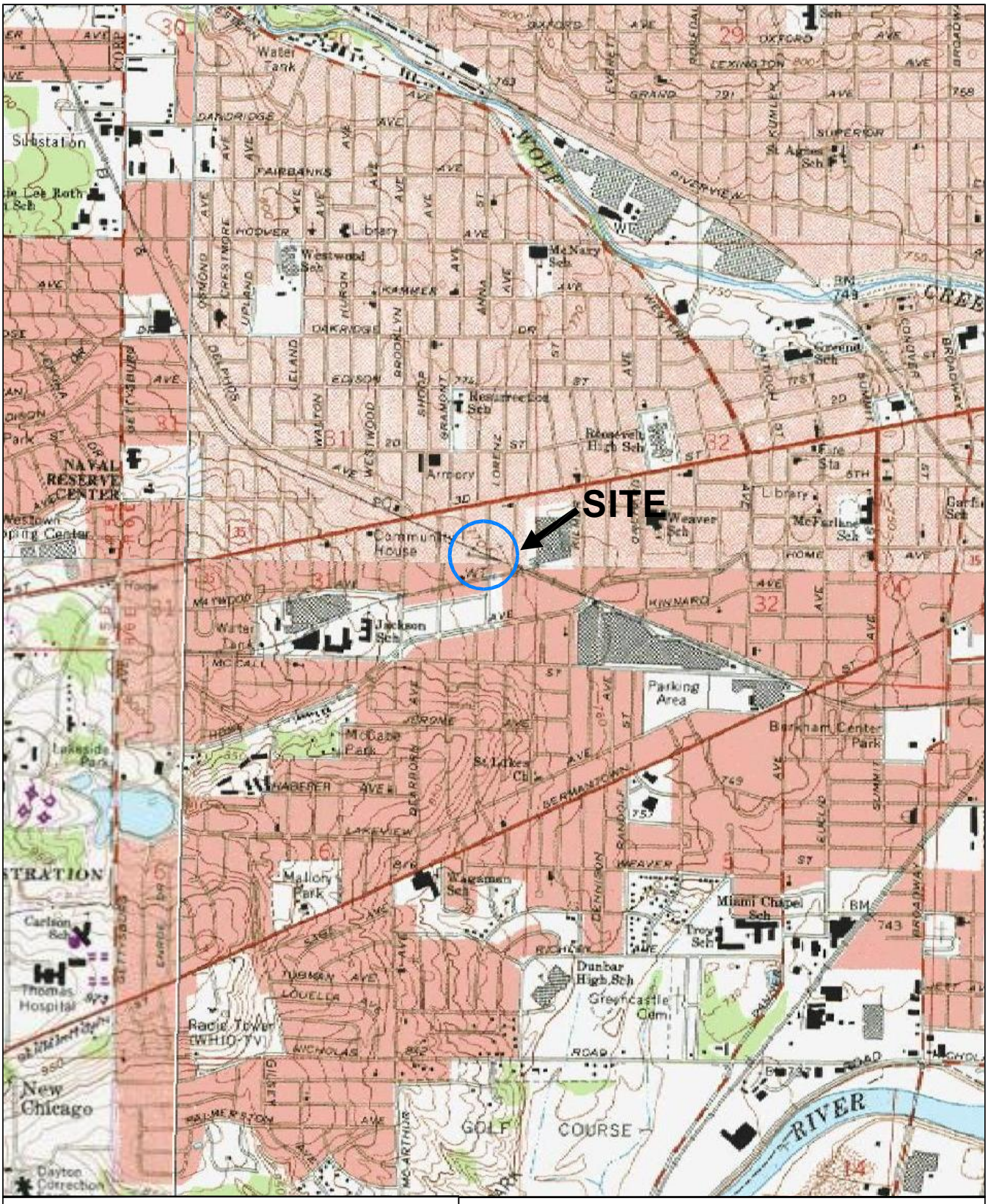
If the results of data evaluation indicate the need to expand the area of investigation, as described in Section 4, Delphi will develop with the U.S. EPA an appropriate schedule for submittal of a subsequent work plan.

Tables

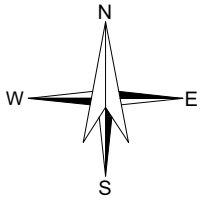
TABLE 1
PHASE II INDOOR AIR SAMPLING MITIGATION
PROPERTY ADDRESSES
DELPHI VOC PLUME SITE

Street Number	Street Name	Description of Residential Structure	Comments
E...	Ex. 6 P... Nam...	Single family structure	
E...	Ex. 6 P... Na...	Single family structure	
E...	Ex. 6 P... N...	Single family structure	
E...	Ex. 6 P... ...	Single family structure	City of Dayton Department of Housing has placed structure in the Nuisance Abatement Program
E...	Ex. 6 P... ...	Single family structure	
E...	Ex. 6 P... ...	Single family structure	
E...	Ex. 6 P... ...	Single family structure	
E...	Ex. 6 P... ...	Single family structure	City of Dayton Department of Housing has placed structure in the Nuisance Abatement Program
E...	Ex. 6 P... ...	Single family structure	Structure appears to be uninhabitable
E...	Ex. 6 P... ...	Single family structure	Attempts to gain permission to sample were initiated in Phase I
E...	Ex. 6 P... ...	Single family structure	Attempts to gain permission to sample were initiated in Phase I
E...	Ex. 6 P... Names, Ad...	Single family structure	
E...	Ex. 6 P... Names, A...	Single family structure	
E...	Ex. 6 P... Names, Ad...	Single family structure	Structure appears to be uninhabitable
E...	Ex. 6 P... Names, Ad...	Single family structure	
E...	Ex. 6 P... Names, Ad...	Single family structure	
E...	Ex. 6 P... Names, Ad...	Single family structure	Attempts to gain permission to sample were initiated in Phase I
Ex...	Ex. 6 P... Names, Ad...	Two-family structure	
E...	Ex. 6 P... Names, Ad...	Single family structure	City of Dayton Department of Housing has placed structure in the Nuisance Abatement Program
Ex...	Ex. 6 P... Names, Ad...	Two-family structure	Attempts to gain permission to sample were initiated in Phase I
E...	Ex. 6 P... Names, Ad...	Single family structure	City of Dayton Department of Housing has placed structure in the Nuisance Abatement Program
E...	Ex. 6 P... Names, Ad...	Single family structure	Structure appears to be uninhabitable
E...	Ex. 6 P... Names, A...	Single family structure	
E...	Ex. 6 P... Names, A...	Single family structure	
E...	Ex. 6 P... Names, A...	Single family structure	
E...	Ex. 6 P... Names, A...	Single family structure	
E...	Ex. 6 P... Names, A...	Single family structure	

Figures



SITE COORDINATES: 39°44'52"N 84°14'30"W



U.S.G.S. QUADRANGLE: DAYTON SOUTH, OHIO

HALEY & ALDRICH

DELPHI AUTOMOTIVE SYSTEMS - HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

PROJECT LOCUS

SCALE: 1:24000
DECEMBER 2007

FIGURE 1

G:\26708\ACAD\26708-LOCUS.DWG

G:\PROJECTS\26708 HOME AVE\VACAD\PHASE I & II STUDY AREA-JAN08.DWG

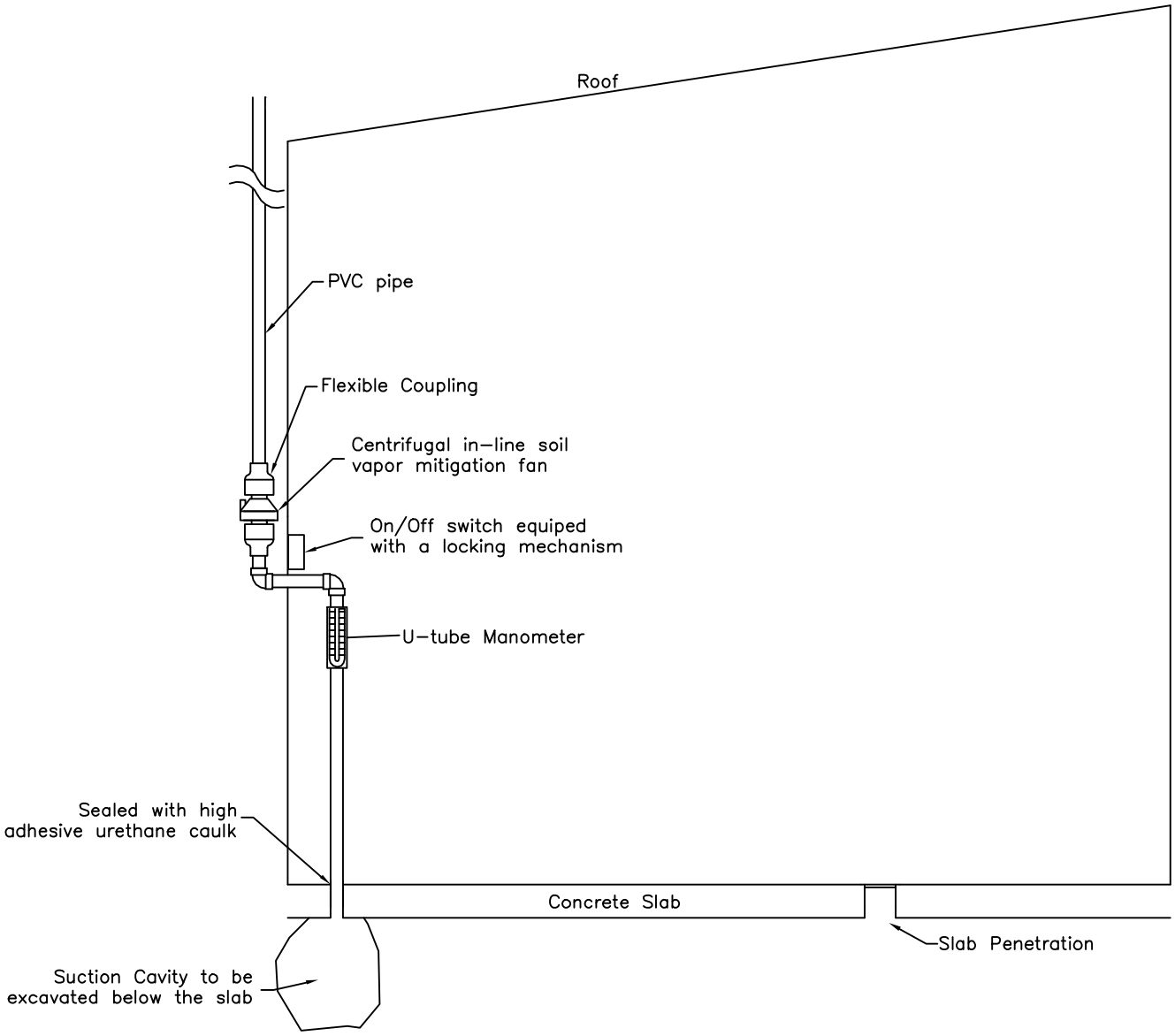
HALEY & ALDRICH

DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

DELPHI VOC PLUME SITE PHASE II

SCALE: AS SHOWN
FEBRUARY 2008

FIGURE 2



SUCTION CAVITY
NOT TO SCALE

TEST LOCATION
NOT TO SCALE

HALEY & ALDRICH

DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

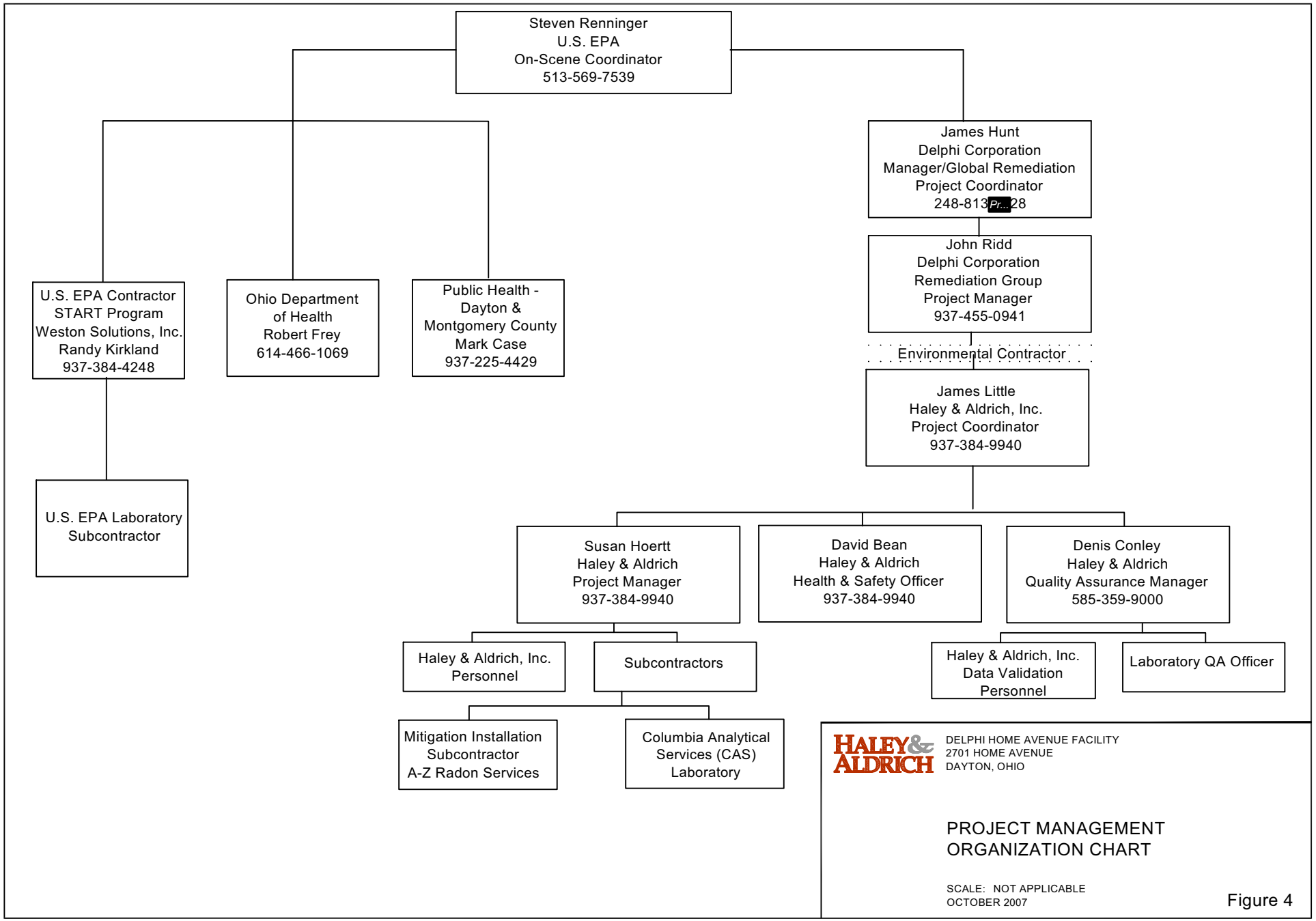
SCHEMATIC OF SUB-SLAB DEPRESSURIZATION SYSTEM

SCALE: NOT TO SCALE
OCTOBER 2007

FIGURE 3

G:\PROJECTS\26708 HOME AVE\079 SVI_INVESTIGATION_WORKPLANS\CERCLAWORK PLAN_PHASE 1\DRAFTS\26708-086-SSD TYP DETAILS.DWG

G:\PROJECTS\26708 HOME AVE\079 SVI_INVESTIGATION_WORKPLANS\CERCLAWORK PLAN_PHASE 1\DRAFTS\ORG CHART.DWG



HALEY & ALDRICH

DELPHI HOME AVENUE FACILITY
2701 HOME AVENUE
DAYTON, OHIO

PROJECT MANAGEMENT
ORGANIZATION CHART

SCALE: NOT APPLICABLE
OCTOBER 2007

Figure 4

APPENDIX A

Health and Safety Plan (HASP)

HALEY & ALDRICH, INC.
HEALTH & SAFETY PLAN

for

Indoor Air Sampling and Mitigation

Delphi VOC Plume Site

Delphi Home Avenue Facility

2701 Home Av., Dayton, OH

Project/File No. 26708

Prepared by: _____ Date: April 2007

Revised by: _____ Date: October 2007

APPROVALS: The following signatures constitute approval of this Health & Safety Plan

_____ _____
David Bean - Local H&S Coordinator Date

_____ _____
Susan Hoertt - Project Manager Date

_____ _____
Corporate H&S Manager Date
(Only required per request of LHSCs)

Date printed: 2/8/2008 at 12:08 PM

Note: This HASP is developed for Haley & Aldrich purposes only and not for use by subcontractors. Subcontractors may use this HASP as reference only.

PRE-JOB SAFETY CHECKLIST

The following is a checklist that is designed to help Project Managers prepare for the H&S requirements needed for their projects.

The use of this form should be used during the planning stage of the project and not intended to be used the day before the project. This form is to be attached to the front off all HASPs before it goes to the field.

Please initial in each appropriate box and sign on the bottom of the appropriate box that the required materials, equipment, training, etc., has been procured before commencement of work on a site.

#	Project H&S Requirements	Approval by PM or LHSC (initial each box or place NA)	Date Approved
1.0	HASP and supporting documentation is complete and signed by all members		
2.0	Task Safety Analysis performed and attached to the HASP.		
3.0	All staff scheduled for project current with 40 hour or 8 hour refresher training.		
4.0	Is a Hazwoper site supervisor needed, if so, are they trained?		
5.0	Additional Training Requirements met: e.g.- Site Supervisor training		
6.0	We have met the client's additional H&S requirements above and beyond H&A's requirements. Example: facility safety orientations, safety documentation, meetings, PPE requirements		
7.0	H&A subcontractors have met H&A's minimum requirements, including- - Training - Medical surveillance - Written HASP - Insurance - MSDSs		
8.0	All H&A staff involved in project have met their Medical Surveillance examination requirements.		
9.0	Staff that may be required to wear a respirator, medically qualified and fit test card available.		
10.0	MSDSs on site and available for chemicals on site.		
11.0	<u>Safety equipment available, such as:</u> Flashlights, Telephone for communications, Cones, Barricade tape, Fire extinguisher, First Aid Kit, PPE, Respiratory Protection, Air Instrumentation and Calibrated, Decontamination equipment		

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ISSUANCE AND COMPLIANCE

- This HASP must be signed by all Haley & Aldrich (H&A) staff members who will work on the project, including H&A visitors.
- This HASP or a current signed copy must be retained at the site at all times when H&A staff are present. Senior management does recognize that it is difficult to utilize one HASP when many staff members are involved and there is no stationary location to maintain the HASP.
- Deviations from this HASP are not permitted without prior approval from the above signed. Unauthorized deviations may constitute a violation of H&A company procedures/policies and may result in disciplinary action.
- Revisions to this HASP must be outlined within the contents of the HASP. If immediate or minor changes are necessary, the LHSC and H&A Project Manager may use Appendix A (HASP Amendment Form), located in the back of this HASP. Any revision to the HASP requires employees to be informed of the changes and they understand the requirements of the change.
- This HASP is not for H&A Subcontractor use. Subcontractors must have their own HASP. This HASP will be made available for review by "reference only" to ensure that H&A has properly informed our subcontractors of the hazards associated with the site to the extent we are aware.
- This Site Specific HASP provides only site-specific descriptions and work procedures. General safety and health compliance programs in support of this HASP (e.g., injury reporting, medical surveillance, personal protective equipment (PPE) selection, etc. are described in detail in the H&A Corporate Health and Safety Program Manual and within Standard Operating Procedures (SOPs). Both the manual and SOPs can be located on the Company Intranet. When appropriate, users of this HASP should always refer to these resources and incorporate to the extent possible. The manual and SOPs are available to clients and regulators per request.

SITE SAFETY OFFICER

This project has identified the following person as the site safety officer (SSO): **The highest ranking Haley & Aldrich, Inc. person on site will be the designated site safety officer.** The H&A Project Manager may designate any person as the primary. **A site safety officer must be on site at all times.**

Roles and Responsibilities

The SSO is responsible for field implementation of this HASP and enforcement of safety rules and regulations. SSO functions include:

- Act as H&A's liaison for health and safety issues.
- Verify required utility clearance has been performed.
- Oversee day-to-day implementation of the HASP by H&A employees on site.
- Interact with subcontractor project personnel on health and safety matters.
- Verify use of required PPE as outlined in the HASP.
- Inspect and maintain H&A safety equipment, including calibration of air monitoring instrumentation used by H&A.
- Perform changes to HASP and document in Appendix A of the HASP as needed and notify appropriate persons of changes.
- Investigate and report on-site accidents and incidents involving H&A and its subcontractors.
- Verify that site personnel are familiar with site safety requirements (e.g., the hospital route and emergency contact numbers).
- Report accidents, injuries, and near misses to the H&A PM and Local Health and Safety Coordinator (LHSC) as needed.

The SSO will conduct initial site safety orientations with site personnel (including subcontractors and Police personnel) and conduct toolbox and safety meetings thereafter with H&A employees and H&A subcontractors at regular intervals and in accordance with H&A policy and contractual obligations. The SSO will track the attendance of site personnel at H&A orientations, toolbox talks, and safety meetings.

The SSO will report accidents such as injury, overexposure, or property damage to the Local Health and Safety Coordinator, to the Project Manager, and to the safety managers of other on-site consultants and contractors. The SSO will consult with the safety managers of other on-site consultants and subcontractors on specific health and safety issues arising over the course of the project, as needed.

PRE-WORK HEALTH & SAFETY BRIEFING

Note: Only H&A employees sign this page.

I have attended a briefing on this Health & Safety Plan prior to the start of on-site work and declare that I understand and agree to follow the provisions and procedures set forth herein while working on this site.

PRINTED NAME	SIGNATURE	DATE

1. PROJECT INFORMATION

Name of Project: Indoor Air Sampling & Mitigation; Delphi VOC Plume Site	**H&A File No.: 26708**
Location: 2701 Home Avenue, Dayton, Ohio	
Client/Site Contact: John Ridd	**Contact Phone No.: 937-455-0941**
H&A Project Manager: Susan Hoertt	**PM Phone No.: 937-384-9940**

SCOPE OF WORK:

Provide environmental consulting services and assist Delphi Corporation with environmental sampling.

Subcontractor(s) to be involved in on-site activities:
Please refer to the Work Plan for information regarding subcontractors.

Projected Start Date: October 2007

Projected Completion Date: To be determined.

Estimated Number of Days to Complete Field Work: Ongoing

2. SITE DESCRIPTION

Check one of the following:

Site classification:	☐ Industrial	☐ Commercial	☑ Other Locations Private Property

General Description

Delphi Corporation – Home Avenue Facility (the "Facility") is located at 2701 Home Avenue SW in Dayton, Montgomery County, Ohio. The Dayton area experiences a humid-continental type climate characterized by large annual and daily temperature fluctuations. Potential heat or cold stresses depend on season. Winds are generally from the southwest, but vary near building spaces.

The Facility covers approximately 67 acres over relatively flat topography with approximately 1.6 million square feet of building space that covers approximately 37 acres. The Facility extends between Upland Avenue (West), McCall Street/US 35 (Home Avenue) (South), Ardmore Avenue (east), and Third Street (North).

Delphi's Home Avenue Facility is located in a mixed industrial, residential, and commercial area in southwest Dayton. The Facility was developed by Inland Manufacturing Division of General Motors Corporation (GM) in 1918 and has continuously operated as an automobile parts manufacturing, shipping, and warehouse facility to the present. In January 1999, Delphi Automotive Systems separated from GM to form a new company. Later the company was renamed Delphi Corporation, with the Facility operating under the Delphi Energy & Chassis (E&C) Systems Division. The Facility currently operates under the Delphi Automotive Holdings Group (DAHG) of Delphi Corporation.

Current and historic products manufactured at the site include:

- Steering Wheels
- Motor Mounts
- Transmission Mounts
- Decorative Trim
- Flexible Body Components
- Weather Strips
- Brake hose
- Liteflex Spring

Processes involved in the manufacturing of these products include:

- Welding
- Metal grinding, sawing, and filing
- Spray painting
- Rubber finishing and adhesive compounds
- Plastic molding and vapor finishing
- Solvent dipping/oven drying of latex weather strips
- Fiberglass resin, epoxy, cutting, and buffing

Work Areas

The type of environmental work being conducted includes investigation and monitoring. The activities associated with this work can affect site employees.

Work area(s) will primarily occur at privately owned properties not owned by Delphi Corporation. Activities may include the following:

1. Health and safety briefings.

2. Soil Vapor and Air Sampling.

3. Construction of Foundation Sub-Slab Mitigation Systems.

4. Mitigation System Operation and Maintenance (O&M) Evaluation.

3. PROJECT TASK BREAKDOWN

List and describe each distinct work task below:

Task No.	Detailed Task Description	Employee(s)	Work Date(s) or Duration
1	Health and Safety Briefing: Review known and suspected health and safety concerns with applicable site personnel. At minimum, personnel will include Haley & Aldrich, Inc. field personnel and Dayton Police personnel. Briefings will be conducted at the Delphi Corporation Home Avenue Facility West 3rd. Street entrance.	Haley & Aldrich, Inc. Staff	Ongoing
2	Soil Vapor and Air Sampling Activities: As needed, install Soil Vapor Monitoring points, adjacent to structures, or through a foundation slab. Canisters used to collect ambient air will be set in locations determined by current wind direction. Activities will be performed in Level D or Level C based on real time air monitoring or established protection levels.	Haley & Aldrich, Inc. Staff	Ongoing
3	Mitigation Construction Activities: As identified by analytical data, homes may require a mitigation system be constructed and installed. Activities will be performed in Level D or Level C based on real time air monitoring or established protection levels.	Haley & Aldrich, Inc. Staff	Ongoing
4	Mitigation Systems Operation and Maintenance (O&M) Evaluation: Following the installation of a mitigation system and at predetermined intervals, the system will be inspected to ensure it is functioning properly. At this time, maintenance issues, if any, will be addressed.	Haley & Aldrich, Inc. Staff	Ongoing

4. HAZARD ASSESSMENT

Chemical Hazards

Material Safety Data Sheets (MSDS) of hazardous materials used during the execution of work shall be available on site. MSDSs are required for chemicals used to prepare samples, calibration gases, etc.

Note: MSDSs are not required for waste materials.

Potential **physical state** of the hazardous materials that may be encountered (mark all that apply).

- ☑ Gas/Vapor
- ☐ Liquid
- ☐ Sludge
- ☐ Solid/Particulate

Anticipated/actual **class of compounds** (mark all that apply).

- ☐ Asbestos
- ☐ BTEX
- ☑ Chlorinated Solvents
- ☐ Heavy Metals
- ☐ Inorganics
- ☐ Pesticides
- ☐ Petroleum products
- ☐ Other

Impacted environments (indicate the primary media(s) in which contamination is expected):

- ☑ Air
- ☐ Soil
- ☐ Surface water
- ☐ Groundwater
- ☐ Sediment
- ☐ Other

Estimated concentrations/medium of major chemicals expected to be encountered by onsite personnel:

Work Activity	Media	Chemical	Anticipated Concentration
Task 1: Health and safety briefings.	Air	VOC	Low
Task 2: Soil Vapor and Air Sampling	Air	VOC	Low to Moderate
Task 3: Mitigation Construction Activities	Air	VOC	Low to Moderate
Task 4: Mitigation System Operation and Maintenance	Air	VOC	Low to Moderate

Please indicate the major chemicals of concern and include a description of each.

Chloroform:
Chloroform is a clear, colorless, and mobile liquid with a pleasant, sweet odor. Air odor threshold concentrations ranging from 85 to 307 parts per million (ppm) parts of air have been reported for chloroform.

Trichloroethylene (TCE):
Trichloroethylene (TCE) is a colorless, nonflammable, non-corrosive liquid has a “sweet” odor characteristic of some chlorinated hydrocarbons.

Tetracloroethylene (PCE):
Tetrachloroethylene (PCE) is a colorless, nonflammable, non-corrosive liquid has a “sweet” odor characteristic of some chlorinated hydrocarbons.

Physical Hazards

Is any site work area(s) to be entered for this project considered a confined space? ☐ Y ☑ N

If yes, indicate which area(s) and why:

NOTE: ALL CONFINED SPACE ENTRY PROJECTS REQUIRE SPECIAL PROCEDURES, PERMITS AND TRAINING AND MUST BE APPROVED BY THE CORPORATE HEALTH & SAFETY MANAGER.

Physical Hazard Checklist

Indicate all hazards that may be present for each task. If any of these potential hazards are checked, it is the project manager's responsibility to determine how to eliminate/minimize the hazard to protect onsite personnel. Note: Task numbers refer to those identified in Section 3.

Potential Job Hazards	Task 1	Task 2	Task 3	Task 4
Underground utilities		✓	✓	✓
Overhead utilities			✓	
Heavy equipment			✓	
Drilling hazards (Hammer Drill)		✓		
Noise (above 85 dBA)	✓	✓	✓	
Traffic concerns	✓	✓	✓	
Extreme weather conditions	✓	✓	✓	✓
Heavy lifting (more than 50 lbs)		✓	✓	
Poisonous insects or plants	✓	✓	✓	✓
Lockout/Tagout requirements			✓	✓
Cold or Heat Stress	✓	✓	✓	✓
Severe Weather	✓	✓	✓	✓

Precautions to be taken with respect to the hazards checked above:

WORKING AROUND HEAVY EQUIPMENT

Site personnel must be especially careful and alert when working with contractors who use heavy equipment, since equipment failure or breakage can lead to accidents and worker injury. Lifting devices and equipment for drilling, pile driving, test pitting and coring are of special concern. Should these devices fail during operation the likelihood of worker injury is high. Equipment of this nature should be visually inspected and checked for proper working order prior to the commencement of fieldwork. Those that operate heavy equipment must meet all of the requirements to operate heavy equipment. Persons that supervise projects or are associated with such high-risk projects that involve digging should use diligence when working with a construction firm.

COLD STRESS

Persons working outdoors in low temperatures, especially at or below freezing are subject to cold stress. Exposure to extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible.

Two factors influence the development of a cold injury: ambient temperature and the speed of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. In addition, water conducts heat 240 times faster than air. Thus when chemical-protective equipment is removed the body cools suddenly if the clothing underneath is perspiration soaked. Warm, dry clothing must be available and donned as soon as possible when these conditions are present.

Frostbite
Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

Frost nip or incipient frostbite: sudden blanching or whitening of the skin.

Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

Deep frostbite: tissues are cold, pale, and solid; extremely serious injury.

To administer first aid for frostbite, bring the victim indoors and rewarm the areas quickly in water between 102 and 105 degree F. (39 and 41 degree C). Never place frostbitten tissue in hot water as the area will have a reduced heat awareness and such treatment could result in burns. Give a warm drink - not coffee, tea or alcohol. The victim should not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws. Then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

After thawing, the victim should try to move the injured areas slightly, but no more than can be done alone, without help.

Do not rub the frostbitten area, use ice, snow, gasoline or anything cold on frostbite, use heat lamps or hot water bottles to rewarm the frostbitten area, place the frostbitten area near a hot stove.

Hypothermia
Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- shivering;
- apathy, listlessness, sleepiness, and rapid cooling of the body to less than 95^{o}F.
- unconsciousness, glassy stare, slow pulse, and slow respiratory rate;
- freezing of the extremities;
- death.

The ultimate responsibility for postponing or delaying work at a site due to inclement weather rests with the Project Manager.

HEAT STRESS

If activities occur during the summer, heat stress is a major concern. Heat stress on hazardous waste sites or construction sites usually is a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated ambient temperatures. Because heat stress is one of the most common and potentially serious illnesses associated with hazardous waste site work, regular monitoring and other preventative measures are vital.

Site workers must learn to recognize and treat the various forms of heat stress.

The best approach is preventative heat stress management. In general:

- Workers should drink 16 ounces of water before beginning work, such as in the morning or after lunch. The water should be maintained at 50 to 60°F. Workers should drink 1 to 2 4-ounce cups of water every 30-60 minutes. A cool area for rest breaks should be designated, preferably air-conditioned. The use of alcohol during non-working hours and the intake of caffeine during working hours can lead to an increase in susceptibility to heat stress. Monitor for signs of heat stress.
- Workers should acclimate to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities. This acclimation process may require up to two weeks for completion.
- Cooling devices should be used to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency. An example of a cooling aid is long underwear that acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.
- Installed mobile showers and/or hose-down facilities should be used to reduce body temperature and cool protective clothing in serious heat stress situations.
- In hot weather, field activities should be conducted in the early morning or evening.
- Adequate shelter should be available to protect personnel from heat, as well as cold, rain, snow, etc., which can decrease physical efficiency and increase the probability of both heat and cold stress. Set up a command post in the shade or erect temporary shade at the work station if practical.
- In hot weather, rotate shifts of workers with potential heat stress exposure.
- Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who develop skin problems should immediately consult medical personnel.

Effects of Heat Stress

If the body's physiological process fails to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal.

Heat-related problems are:

Heat Stroke: An acute and dangerous reaction to heat exposure caused by failure of heat regulating mechanisms of the body; the individual's temperature control system that causes sweating stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

- Symptoms: Red, hot, dry skin, although person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory

and pulse rate; unconsciousness or coma.

- Treatment: Cool the victim quickly and obtain immediate medical assistance. If the body temperature is not brought down fast, permanent brain damage or death may result. Soak the victim in cool but not cold water, sponge the body with rubbing alcohol or cool water, or pour water on the body to reduce the temperature to a safe level (102°F). Observe the victim and obtain medical help. Do not give coffee, tea or alcoholic beverages.

Heat Exhaustion: A state of definite weakness or exhaustion caused by the loss of fluids from the body. This condition is much less dangerous than heat stroke, but it nonetheless must be treated.

- Symptoms: Pale, clammy, moist skin, profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, breathing is shallow. The person may have a headache, may vomit, and may be dizzy.
- Treatment: Remove the person to a cool place, loosen clothing, place in a head-low position. Provide bed rest. Consult physician, especially in severe cases. The normal thirst mechanism is not sensitive enough to ensure body fluid replacement. Have patient drink 1 to 2 cups water immediately and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

Heat Cramps: Caused by perspiration that is not balanced by adequate fluid intake. Heat cramps are often the first sign of a condition that can lead to heat stroke.

- Symptoms: Acute painful spasms of voluntary muscles (e.g., abdomen and extremities).
- Treatment: Remove the victim to a cool area and loosen clothing. Have the patient drink 1 to 2 cups water immediately, and every 20 minutes thereafter until symptoms subside. Total water consumption should be 1 to 2 gallons per day.

Heat Rash: Caused by continuous exposure to heat and humid air and aggravated by chaffing clothes. Decreases ability to tolerate heat.

- Symptoms: Mild red rash, especially in areas of the body on contract with protective gear.
- Treatment: Decrease amount of time in protective gear, and provide powder to help absorb moisture and decrease chaffing.

SEVERE WEATHER

Below is a short guideline to assist those in the field to make better decisions when dealing with lightening. This information shall be used as needed when in the field and lightning is approaching.

Anticipating Lightning: Lightning always accompanies thunderstorms, so your first line of defense is to keep an eye and ear to the sky.

- Equate thunder with lightning, even if lightning is not visible where you are. If you can hear thunder, you are close enough to be struck by lightning.
- Even if you can't hear thunder, you might nonetheless be at risk. The first bolts from a towering cloud overhead can catch you by surprise, and so-called "bolts from the blue" can extend way out from the edge of a thunderstorm and strike a point well

away from where most of the thunder and lightning is occurring.

How Close Is the Lightning? You can do a rough calculation this way:

- When you see the flash, begin to count the seconds until you hear the thunder. Divide this number by 5. The number you get is the approximate distance of the lightning in miles. For example, if you count nine seconds between the flash and the thunder, the lightning struck just less than two miles away.

How Will You Be Warned? There are no watches or warnings issued for lightning per second. Though severe thunderstorms can certainly contain a lot of lightning, not all of them do, and many thunderstorms laden with lightning occur without being designated "severe" and without any watches or warnings in effect.

- Severe thunderstorms are defined as those which produce hail 3/4" in diameter or larger, wind gusts 58 mph or greater, and/or tornadoes.
- Severe Thunderstorm Watch conditions are conducive to the development of severe thunderstorms in and close to the watch area.
- Severe Thunderstorm Warning a severe thunderstorm has actually been observed by spotters or indicated on radar, and is occurring or imminent in the warning area.

If you are on a project and a lightning storm is approaching:

- Always pay attention to the weather conditions. You are responsible for your own safety. Use common sense and do not feel pressure to continue to work if you feel there is a threat and others don't, such as contractors and co-workers.
- If you are using conductive tools and equipment, separate yourself from them as far as practical.
- If you are near a drilling rig, lower the mast and move away from the rig.
- Rule of thumb- wait until 30 minutes after the last observed lightning strike or thunderclap before resuming your outdoor activities, warns the National Lightning Safety Institute.
- Protect yourself by taking cover in the best shelter you can find.
- For shelter, if choosing between a building on the Facility or an off site building, choose a building off site.
- If choosing between an off site building and a car, choose the off site building.
- If choosing between a hardtop and a convertible, choose the hardtop.
- If you're in a car, keep the windows closed.
- If there is no shelter, find a low-lying, open place that is a safe distance from trees, poles, or metal objects that can conduct electricity. Make sure it is not likely to flood. Assume a tucked position: Squat low to the ground. Place your hands on your knees with your head tucked between them. Try to touch as little of your body to the ground as possible.
- Do not lie flat on the ground, as your fully extended body will provide a larger surface to conduct electricity. Stay in a tuck position well after the storm passes.
- Watch for local flooding you may have to move if water begins to accumulate.
- If you feel your hair stand on end in a storm, drop into the tuck position immediately. This sensation means electric charges are already rushing up your body from the ground toward an electrically charged cloud. Minimize your contact with the ground to minimize your injury.

Hazardous Energy

Lockout/tagout (LOTO) refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities. For the activities discussed herein, H&A staff members will not facilitate the LOTO Program, the facilities existing LOTO Program will be used. H&A staff will be operating within Delphi's LOTO Program and therefore must be aware of the LOTO Program requirements.

Delphi will provide information on how H&A staff will be trained in their program. It is the PM's responsibility to ensure that authorized staff members receive the training and that proof of the training in written form is provided.

Staff members who participate in a LOTO Program are required to fully understand the theory behind the LOTO Program. Isolation points must be locked out and tagged out before an individual performs service or maintenance activities where unexpected energization, startup, or release of energy or hazardous material could cause injury or damage equipment. LOTO Programs must comply with the OSHA requirements specified in 29 CFR 1910.147.

Staff members are required to comply with the restrictions and limitations imposed upon them during the use of the Facilities LOTO Program. All employees, upon observing a machine or piece of equipment which is locked out to perform servicing or maintenance shall not attempt to start, energize, or use that machine or equipment. The PM, or authorized designee, shall notify staff when it is safe to properly operate the equipment.

Electrical Hazards

Electrical current exposes personnel to an occupational hazard. Electrical injuries consist of four main types: electrocution (fatal), electric shock, burns, and falls caused as a result of contact with electrical energy. Every individual who works with or around electrical energy should be familiar with LOTO Program emergency procedures. This includes knowing how to de-energize the electrical system before rescuing or beginning resuscitation on a worker who remains in contact with an electrical energy source.

Noise

When employees are subjected to sound exceeding those listed in Table G-16, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of table of Permissible Noise Exposure shown below, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.

PERMISSIBLE NOISE EXPOSURES (1)

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Footnote(1) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C(1)/T(1) + C(2)/T(2) C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. Cn indicates the total time of exposure at a specified noise level, and Tn indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

5. PROTECTIVE MEASURES

Personal Protective Equipment Requirements

Required PPE	Task 1	Task 2	Task 3	Task 4
Steel-toe footwear	✓	✓	✓	✓
Hearing protection (plugs, muffs)		✓(1)	✓(1)	
Leather work gloves			✓ (2)	✓ (2)
Outer gloves - Nitrile		✓		
High-Visibility Safety Vest (in traffic areas)		✓	✓	
Lockout/Tagout Procedure			✓ (2)	✓ (2)
Respirator		✓ (3)	✓(3)	✓(3)

✓**(1):** When using a generator or other loud equipment (drill)
✓**(2):** During installation & maintenance activities (i.e., not during operation)
✓**(3):** As determined by real time air monitoring.

The PPE checked in any box above must be on site during the task being performed. Work shall not commence unless the PPE is present.

In the event of respirator use, H&A staff that may be required to wear a respirator must be:

- Medically qualified
- Fit tested
- Fresh shaven with no facial hair that will interfere with the seal. This includes one day hair growth or more, beards, excessive long side burns, and goatees.

Personal Hygiene Safeguards

Describe any additional safeguards other than basic decontamination procedures for personal hygiene. The following safeguards, at a minimum, shall be adhered to:

1. No Smoking or tobacco products
2. No eating or dinking in exclusion (hot) zones; and
3. It is especially important to wash your hands before eating, smoking, taking medication, chewing gum/tobacco, using the restroom, or applying cosmetics and before you leave the site for the day. It is recommended that personnel present on site shower or bathe at home at the end of each day of working on the site.

Site Safety Equipment

Check all items that are required to be on site:

☐ Fire Extinguisher	☑ First Aid Kit	☑ Flashlight
☐ Air horn/signaling device	☑ Cellular Phone	☐ Duct tape
☐ Ladder	☐ Barricade tape	☐ Drum dolly
☐ Two-way radio	☑ Safety cones	☐ Harness/Lanyard

☑ Other City of Dayton Police Officer

The equipment checked in any box above must be on site during the task being performed. Work shall not commence unless the equipment is present.

Site Security & Work Area Controls

Access to each work area will be controlled during on-site activities as follows:
Consider protection of both project and non-project personnel (e.g., general public).

Work areas will be designated and established in areas identified by Haley & Aldrich personnel in conjunction with applicable home owners.

The "buddy system" is to be enforced at a minimum while work is being conducted at a private property. The "buddy system" will also be enforced when circumstances arise that warrant it's use and after consultation with the Project Manager. When working under the "buddy system", personnel are to:

- never work alone;
- provide their partner with assistance;
- observe partner for signs of over-exposure/temperature stress;
- check integrity of partner's protective clothing;
- notify others if emergency help is needed; and
- when wearing respiratory protective equipment, personnel must maintain visual contact with their buddy.

Sampling at a private property may proceed only after the owner has been contacted, and provided a signed authorization to proceed. Additionally, investigation and/or construction work will neither commence nor continue unless a City of Dayton Police Officer is present at the property. If at any time the City of Dayton Police officer must leave the property, the Haley & Aldrich, Inc. personnel and subcontractors must also leave until such time an Officer is able to return.

Training Requirements

5.1.1 Health and Safety Training

Personnel will not be permitted to supervise or participate in field activities until they have been trained to a level required by their job function and responsibility. H&A staff members, contractors, subcontractors, and consultants who have the potential to be exposed to contaminated materials or physical hazards must complete the training described in the following sections.

The H&A Project Manager/LHSC will be responsible for maintaining and providing to the client/site manager documentation of H&A staff members' compliance with required training as requested. Records shall be maintained per OSHA requirements.

5.1.2 40-Hour Health and Safety Training

The 40-Hour Health and Safety Training course provides instruction on the nature of hazardous waste work, protective measures, proper use of personal protective equipment, recognition of signs and symptoms which might indicate exposure to hazardous substances, and decontamination procedures. It is required for all Haley & Aldrich, Inc. personnel working on-site, such as equipment operators, general laborers, and supervisors, who may be potentially exposed to hazardous substances, health hazards, or safety hazards consistent with 29 CFR 1910.120.

5.1.3 8-hour Annual Refresher Training

Personnel who complete the 40-hour health and safety training are subsequently required to attend an annual 8-hour refresher course to remain current in their training. When required, site personnel must be able to show proof of completion (i.e., certification) at an 8-hr refresher training course within the past 12 months.

5.1.4 8-Hour Supervisor Training

On-site managers and supervisors directly responsible for, or who supervise staff members engaged in hazardous waste operations, should have eight additional hours of Supervisor training in accordance with 29 CFR 1910.120. Supervisor Training includes, but is not limited to, accident reporting/investigation, regulatory compliance, work practice observations, auditing, and emergency response procedures.

5.1.5 Additional Training

H&A personnel will ensure their personnel have received additional training on specific instrumentation, equipment, confined space entry, construction hazards, etc., as necessary to perform their duties. This specialized training will be provided to personnel before engaging in the specific work activities. Any staff member engaging in the following activities will be required to have additional training:

- Client specific training or orientation
- Competent person excavations

- Confined space entry (entrant, supervisor, and attendant)
- Heavy equipment including aerial lifts and forklifts
- First aid/ CPR
- Diving
- Use of fall protection
- Commercial Drivers License
- Use of Nuclear Density Gauges
- Asbestos

6. MONITORING PLAN AND EQUIPMENT

Do any activities require air/**exposure monitoring** during work for personal protection? ☑ Y ☐ N

Is **perimeter monitoring** required for community protection? ☐ Y ☑ N

Monitoring/Screening Equipment

- ☑ HNu analyzer (PID) ☐ 10.2eV ☑ 11.7eV
- ☐ Organic vapor monitor (FID)
- ☐ Photovac Micro Tip, 10.6eV
- ☐ Photovac GC
- ☐ Other
- ☐ Combustible Gas Indicator (CGI) (LEL)
- ☐ Multiple Gas Detector-LEL/O_2/H_2S/CO
- ☐ Dust Monitors (RAMs)
- ☐ Colorimetric tubes

Standard Action Levels And Required Responses

For readings obtained with a multiple gas detector or an individual monitoring instrument are listed in Table 2. Specific Ionization potentials and exposure limits are listed in Table 1.

Description of Monitoring Requirements (include frequency and location by Task):

Monitoring Plan for Task Number(s):	2,3	Frequency	1	times per	Hour

Notes: Exposure Guidelines for common contaminants are listed in **Table 1**
Requirements for PPE upgrades based on monitoring are in **Table 2**

Record monitoring data and PPE upgrades on **Record of Field Monitoring** form **http://intranet/Health_Safety/590/1874/Frm_4003%20Field%20Monitor%20Record.xls**; maintain with project files.

Calibration and use of Equipment

Calibrate all monitoring equipment in accordance with manufacturers requirements and site specific requirements (e.g., at the beginning and end of each work day).

Air monitoring for exposure should be based on the frequency established above (see Section 6.2). If action is required record time, location, results of monitoring and actions taken based upon the readings.

Use the H&A established SOPs for equipment calibration in the H&A SOPs located on the Intranet.

7. DECONTAMINATION

Personnel Decontamination

Are **decontamination procedures** required for personnel working on site? ☑ Y ☐ N
Large or heavy equipment is not expected to be utilized for any tasks associated with this project. Therefore, all decontamination activities of small equipment and containerization of small quantities of waste are expected to be able to be performed at the work location. Disposal of wastes shall be performed as described below.

Decontamination procedures required for personnel working on site:

1. Every site worker who comes in contact with soil during site activities must wash their hands before eating, drinking, or smoking or when leaving each work area. Hand washing facilities (soap, potable water, and towels) must be provided at the decon station at each work location. Potable drinking water, stationed at a support vehicle, will be provided near each work location.

2. All disposable PPE will be removed with care, not exposing any part of the body to the contaminants. They will be discarded in to a suitable container for proper disposal.

3. All non-disposable PPE such as respirators will be cleaned with soap (non-phosphate) and water to the degree that is necessary to remove visible contamination.

4. No disposable PPE will be used the following day, new disposable PPE will be used daily. If cartridges are used for respirators, they must be discarded daily and new ones used.

5. All workers must wash their hands and any other body part that has come in contact with soil after each time they remove their PPE. If an employee's personal clothing is soiled by soil the clothing should not be worn again until it has been laundered. Contaminated clothing should be laundered separately.

Location of decontamination station: Building 16, Home Avenue Facility

Disposal of PPE: Dispose of all PPE in disposal bags. PPE is to be bagged, labeled, and turned over to the Facility for profiling, manifesting, and disposal. No PPE will be disposed of in a non-Delphi owned private property refuse container.

Tools & Equipment Decontamination

All decon should be conducted at the Delphi Home Avenue Facility and not at the office or a non-Delphi owned property. If decon of small equipment must be performed at the work location, all decon materials and PPE must be containerized and transported to the Delphi Home Avenue Facility for profiling and disposal.

Check all **equipment and materials needed for decontamination** of tools and other equipment:

☐ Acetone	☐ Distilled water	☐ Poly sheeting
☑ Alconox soap	☑ Drums for water	☐ Steam cleaner
☑ Brushes	☐ Hexane	☑ Tap water
☑ Disposal bags	☐ Methanol	☑ Washtubs
☑ Other Paper Towels		

Outline the **equipment decontamination procedures** for this project:

1. Contractors are responsible to decontaminate their own equipment.

   - Exploration equipment must be decontaminated prior to initiating site activities, in between exploration locations to minimize cross-contamination potential, and prior to mobilizing off site after completion of site work. Heavy equipment is generally best deconned with a combination of steam-cleaning equipment and detergent scrubbing. Particular attention should be paid to parts in direct contact with contaminants, e.g., shovels, tires, augers, drilling decks, etc.
   - Contractors are responsible for the construction/destruction of an appropriate decontamination pad. Decontamination activities will occur on this pad.

2. Prior to leaving the work area, personnel handling equipment or soils will be required to wash their hands with soap and water.

Disposal methods for contaminated decontamination materials (e.g., wash water, rags, brushes, poly sheeting) will consist of:

The wash water will be containerized in a suitable container (drum, frac tank) on-site. Other decontamination-spent materials will be containerized in drums and labeled appropriately.

8. CONTINGENCY PLANNING

How H&A responds to an emergency depends on whether we are at an active facility or another other location. **Many active facilities have very stringent requirements for the mitigation of emergencies.** Therefore, the PM is responsible for identifying any specific requirements from the client contact.

As a rule of thumb, the following are H&A's basic responses to handling Emergencies. Typically, H&A does not mitigate emergencies. When Clients request or require specific functions such as First Aid/CPR trained personnel on site, we typically conform. Before any Project Manager or LHSC agrees to something more stringent, many issues should be considered such as training, safety, feasibility of an adequate response, insurance requirements, and much more.

Fire

- Major Fires - Major fires will be mitigated by the local fire departments or by client's on-site fire/emergency response departments.
- Incipient Stage Fires -Incipient stage fires will be extinguished by on-site personnel using fire extinguishers. Only those who have received annual training in the use of a fire extinguisher may use an extinguisher.

Medical

All H&A employee injuries and illnesses will be documented using the Supervisor's Accident / Injury / Near Miss Report (SAIR). This form is available on the Intranet.

- First Aid - First aid will be addressed using the on-site first aid kit. H&A employees are *not required or expected* to administer first aid/CPR to any H&A, Contractor, or Civilian personnel at any time and it is H&A's position that those who do are doing it on their behalf and not as a function of their job.
- Trauma - Based upon the nature of the injury, the injured party may be transported to the nearest hospital or emergency clinic by on-site personnel or by ambulance. First response to a trauma incident is to call 911 or Facility security. H&A staff members are expected to assist in ancillary roles only such as directing ambulances to the scene. It is the discretion of the staff member on site whether an ambulance should be procured in remote locations where ambulance services will not be effective.

Hazardous Materials Spill

- Small incidental spills (e.g.- pint of motor oil) caused by H&A employees and/or by the contractor will be mitigated by the H&A staff member and/or the contractor.
- Large spills (e.g.- large leak from heavy equipment fuel tank) The contractor is responsible for cleanup. In the event that it posses a serious human or environmental threat, the local Fire Department and/or client emergency response department will be contacted. Once emergency has been mitigated typically clean up will be provided by a vendor.

Rescue

H&A employees will not enter any confined spaces for rescue purposes. In the event of electrocution or electrical shock and prior to initiating a recovery/rescue, assure equipment is de-energized or the person is not in contact with the power source.

Weather Related Emergencies

H&A employees and their subcontractors should be aware of potential health effects and/or physical hazards of working during inclement weather. If applicable, the effects and hazards of heat stress, cold stress, frostbite, thunderstorms, lightning, etc., should be outlined in Section 4.0, or the H&A SOP should be included if one exists.

Emergency Alarming and Communication

In the event of an emergency, on site H&A personnel and Subcontractors shall assemble in a designated area. Role shall be completed by the SSO or senior-most H&A person present. No personnel shall leave the assembly area unless directed to do so by Project management, the SSO, or recognized emergency response agency (e.g., police, fire department).

Evacuation alarms and/or emergency information will be communicated among personnel on site by the following means: Verbal communication or hand signals.

Emergency services will be summoned: Via on-site cellular phone.

The **site evacuation plan** is as follows:

Evacuation to the nearest Hospital:

Miami Valley Hospital
One Wyoming St.
Dayton, Ohio 45409
(937) 208 8000

(Approximate Distance 3.5 miles)

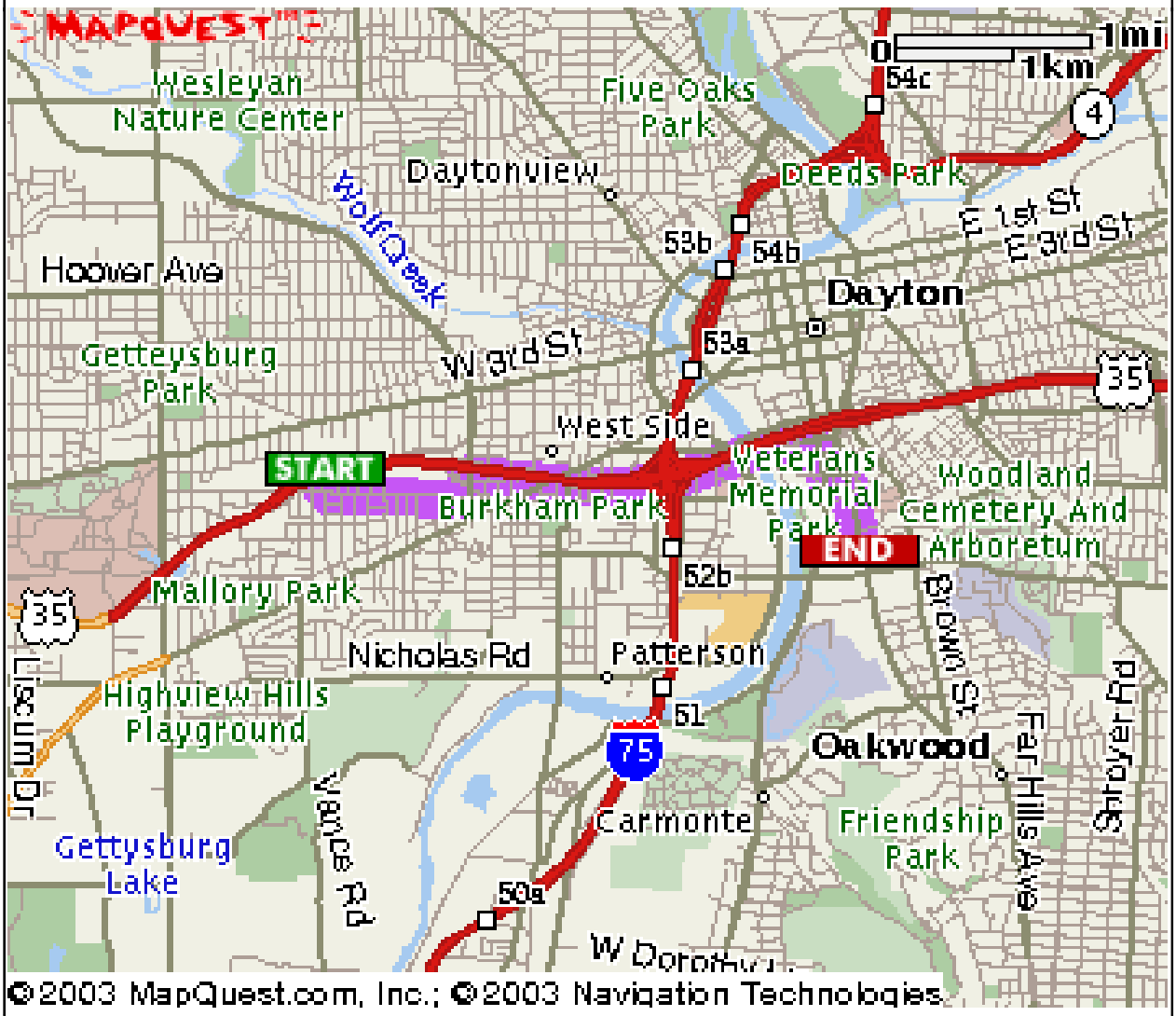
Hospital Evacuation Route from Site

- Go South on Inland Ave toward McCall St.
- Turn Left onto McCall St.
- Turn Left onto S James H. McGee Blvd.
- Merge onto US-35 E via the ramp on left
- Merge onto I-75 N toward Toledo
- Take the OH 49/First St exit (exit #53B) toward SALEM AVE
- Take the First St. ramp toward DOWNTOWN
- Turn slight right onto W 1st ST.
- Turn right onto N Main St/OH-4 S

EMERGENCY RESPONSE RESOURCES

Nearest Hospital: (see attached map) Address: Phone Number:	Miami Valley Hospital One Wyoming Street 937-208-8000
Emergency Response Number:	**911**
Local Emergency Response Number (if not on 911 system):	 N/A
Other Ambulance, Fire, Police, or Environmental Emergency Resources:	Fire: 937-333-3473 Police: 937-333-2677
H&A Project Manager: Phone Number: Emergency Phone Number: Client Contact/Project Manager: Phone Number: Emergency Phone Number:	Sue Hoertt 937-384-9940 937-620-3799 (cell) John Ridd 937-455-0941 937-901-3755 (cell)
Other Entity: Address: Phone Number:	

(**Route to Hospital Highlighted**)



APPENDIX A
HASP Amendment Form

This Appendix is to be used whenever there is an immediate change in the project scope that would require an amendment to the HASP. For project scope changes associated with "add-on" tasks, the changes must be made in the body of the HASP. Before changes can be made, a review of the potential hazards must be initiated by the H&A Project Manager.

Amendment No.	
Site Name:	
Work Assignment No.:	
Date:	
Type of Amendment:	
Reason for Amendment:	
Alternate Safeguard Procedures:	
Required Changes in PPE:	

Project Manager Signature: _____ Date: _____

Local Health and Safety Coordinator : _____ Date: _____

This original form must remain on site with the original HASP. If additional HASPs are in the field, it is the PMs responsibility to forward a signed copy of this amendment to those who have copies.

APPENDIX B

Standard Operating Procedures for Construction and Installation of Permanent Sub-slab Soil Gas Wells

REAC
Response Engineering and Analytical Contract

STANDARD OPERATING PROCEDURES

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

CONTENTS

CONSTRUCTION AND INSTALLATION OF PERMANENT SUB-SLAB SOIL GAS WELLS

1.0 SCOPE AND APPLICATION

Soil gas monitoring provides a quick means of detecting volatile organic compounds (VOCs) in the soil subsurface. Using this method, underground VOC contamination can be identified, and the source, extent, and movement of pollutants can be traced.

This standard operating procedure (SOP) outlines the methods used for the construction and installation of permanent sub-slab soil gas wells. The wells are utilized to sample the gas contained in the interstitial spaces beneath the concrete floor slab of dwellings and other structures. The thickness of a concrete slab may vary from structure to structure. A structure may have a single slab where the thickness varies. The type of equipment described in this standard operating procedure (SOP) may be purchased at a local home center or hardware store and should allow the installation of a soil gas well in a slab up to 8-inches thick. Equipment can be purchased to drill thru a slab of greater thickness, however this equipment may not be available locally. These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Using an electric Hammer Drill or Rotary Hammer, an inner or pilot hole is drilled into the concrete slab to a depth of approximately 2 inches (") with the 3/8" diameter drill bit. Using the pilot hole as the center, drill an outer hole to an approximate depth of 1 3/8" using the 1" diameter drill bit. Replacing the 3/8" diameter drill bit continue to drill the pilot hole thru the slab and several inches into the sub-slab material. Once drilling is completed, a stainless steel probe is assembled and inserted into the pre-drilled hole. The probe is mounted flush with the surrounding slab so it will not interfere with pedestrian or vehicular traffic and cemented into place. A length of Teflon® tubing is attached to the probe assembly and to a sample container or system. Sample collection may now begin.

3.0 EQUIPMENT/APPARATUS

Hammer Drill or Rotary Hammer
AC extension cord
AC generator (if AC power is not available on site)
Hammer or Rotary Hammer drill bit, 3/8"diameter
Hammer or Rotary Hammer drill bit, 1"diameter
Portable vacuum cleaner
(1) 3/4" open end wrench or (1) medium adjustable wrench
(2) 9/16" open end wrenches or (2) small adjustable wrenches
Hex head wrench, 1/4"
Tubing cutter

Bucket
Trowel or putty knife
Swagelok® SS-400-7-4 Female Connector, 1/4"NPT to 1/4" Swagelok® connector
Swagelok® SS-400-1-4 Male Connector, 1/4"NPT to 1/4" Swagelok® connector
1/4"NPT flush mount hex socket plug, Teflon® coated
1/4"OD stainless steel tubing, pre-cleaned instrument grade
1/4"OD Teflon® tubing
Teflon® thread tape
Anchoring cement (requires water for mixing)
Modeling clay

4.0 PROCEDURE FOR PROBE ASSEMBLY AND INSTALLATION

- Drill a 3/8"diameter inner, or pilot hole to a depth of 2". (Figure 1)
- Using the 3/8" pilot hole as your center, drill a 1" diameter outer hole to a depth of 1 3/8". (Figure 2)
- Vacuum out any cuttings from the hole.
- Continue drilling the 3/8" inner, or pilot hole thru the slab and a few inches into the sub-slab material. (Figure 3)
- Figure 4 details installed probe assembly.
- Vacuum out any cuttings from the outer hole.
- Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, thru the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material. Cut the tubing to the desired length.
- Attach the measured length of 1/4"OD stainless tubing to the female connector with the Swagelok® nut. Tighten the nut.
- Insert the 1/4" hex socket plug into the female connector. Tighten the plug. **Do not over tighten**. If excessive force is required to remove the plug during the sample set up phase the probe may break loose from the anchoring cement.
- Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole.
- Mix a small amount of the anchoring cement. Fill the space between the probe and the outside of the

outer hole. Allow the cement to cure according to manufacturers instructions before sampling.

5.0 PROCEDURE FOR SAMPLING SETUP

Complete the sampling setup (Figure 5) as follows:

- Wrap one layer of Teflon® thread tape onto the NPT end of the male connector.
- Remove the 1/4" hex socket plug from the female connector. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Screw and tighten the male connector into the female connector. **Do not over tighten**. This may cause the probe to break loose from the anchoring cement during this step or when the male connector is removed upon completion of the sampling event. Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.
- Attach a length of 1/4"OD Teflon® tubing to the male connector with a Swagelok® nut. The Teflon® tubing is then connected to the sampling container or system to be utilized for sample collection.
- After sample collection remove the male connector from the probe and reinstall the hex socket plug. **Do not over tighten** the hex socket plug. If excessive force is required to remove the plug during the next sampling event the probe may break loose from the anchoring cement .Refer to Section 6.0 if the probe breaks loose from the anchoring cement during this step.

6.0 PROCEDURE FOR REPAIRING A LOOSE PROBE

- If the probe breaks loose from the anchoring cement while removing or installing the hex head plug, or the male connector, lift the probe slightly above the surface of the concrete slab.
- Hold the female connector with the 3/4"open end wrench.
- Complete the step being taken during which the probe broke loose, following the instructions contained in the standard operating procedure (SOP). (i.e. **Do not over tighten** the hex socket plug or male connector)
- Push the probe back down into place and reapply the anchoring cement.
- Modeling clay may be used as a temporary patch to affect a seal around the probe until the anchoring cement can be reapplied.

APPENDIX C

Standard Operating Procedure for Indoor/Outdoor Ambient Air Sampling

INDOOR/OUTDOOR AIR SAMPLING OPERATING PROCEDURE	
INDOOR AIR SAMPLING AND MITIGATION DELPHI AUTOMOTIVE HOLDINGS GROUP, HOME AVENUE FACILITY	EFFECTIVE DATE: OCTOBER, 2007
REVISION #: **0**	REVISION DATE:

INDOOR/OUTDOOR AMBIENT AIR SAMPLING

INTRODUCTION

This operating procedure explains the procedure to be followed for the collection of indoor or outdoor air for laboratory analysis in accordance with USEPA Method TO-15.

SUPPLIES/ EQUIPMENT REQUIREMENTS

- Vacuum canister with tag
- Laboratory Calibrated Flow controller
- Pressure gauge
- Garbage bags
- Pocketknife
- Nitrile gloves
- Adjustable wrench
- Tape measure
- Camera/batteries
- Watch
- FID or PID

OUTDOOR OR INDOOR AIR SAMPLING

Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

Verify the sampling location and assign a unique identification. Observe the area immediately surrounding the proposed location and note the presence of any potential sources of VOCs present (i.e. open paint cans, gasoline cans, lawn mower etc.). If approved by the homeowner and/or tenant, remove potential sources prior to sampling. If unapproved, locate an alternate suitable location for sample collection and note reason for change.

INDOOR OR OUTDOOR AIR SAMPLING

Equipment calibration, field documentation, sampling, and chain of custody procedures will be conducted in accordance with the Project Work Plan (WP) and Quality Assurance Project Plan (QAPP). Personal protective equipment will be donned in accordance with the requirements of the Project Health and Safety Plan.

1. For indoor air sample locations, the canister should be placed 2-4 feet from the floor in the "breathing zone".
2. Outdoor sample locations will be selected after reviewing factors such as wind direction, weather, safety and proximity to soil vapor sample location.
3. Attach the gauge to the canister and open the valve approximately 1¼ turn. Record the initial vacuum, close the valve, and attach the flow controller.
4. If separate flow controller and vacuum gauges are provided, be sure to select the appropriate flow controller for the location.
5. Open the valve on the canister and record the sample start time on the sampling record.
6. At the conclusion of the designated sample duration, record the final time and vacuum and close the valve.
7. Remove the vacuum gauge and flow controller and replace the ¼" cap on the canister inlet. Label the canister sample tag with a unique ID.
8. Fill-in the Chain of Custody (COC) with appropriate information. Minimum information required on the COC is noted below. Retain copies of the COC record and relevant shipping information in the project files. Place canisters back into their original boxes and ship them to the laboratory.

    - Sample number/ID
    - Date and time
    - Parameters to be analyzed
    - Project Number
    - Sampler's initials

FIELD NOTES

Field notes are intended to document events, equipment used, and measurements collected during the sampling activities. Field forms may include the following information:

- Identification of soil vapor well point location
- Soil vapor well point depth
- Purge volume and pumping rate
- The amount of time required to purge the point
- Purge/sampling device used
- Sample identification

- Parameters requested for analysis
- Laboratory to which samples were shipped
- Chain of custody number for shipment to laboratory
- Field observations on sampling event
- Name of sample collector(s)
- Climatic conditions including air temperature
- Problems encountered and any deviations made from the established sampling protocol.
- Sample Identification Key

REFERENCES

1. U.S.E.P.A., Soil Gas Sampling SOP# 2042, 1 June 1996, REV. #: 0.0

2. Compendium of Methods for the Determination of Organic Compounds in Ambient Air, EPA/625/R-96/010a, 2nd Edition, June 1999, USEPA ORD, Washington DC.

3. USEPA RCRA Groundwater Monitoring: Draft Technical guidance (EPA/530-R-93-001).

4. New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York", October 2006.

5. USEPA "DRAFT Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion)", 2002.

APPENDIX D

Air Assessment Questionnaire and Building Inventory for Residential Structures

INDOOR AIR ASSESSMENT QUESTIONNAIRE AND BUILDING INVENTORY FOR RESIDENTIAL STRUCTURES

Form Completed by: _____
Date/Time Initial Call/Visit: _____
Date/Time Follow-up Call/Visit:_____

1. OWNER OR LANDLORD _____(Check if same as occupant)
Interviewed: Y/N

First Name: _____ Last Name: _____

Address:_____

Contact information:
Home Phone: _____ Cell Phone: _____
Work Location/Phone:_____

Preferred means and time(s) to contact:
In person _____ At Home by Phone _____
At Work by Phone _____By Cell Phone _____

How long have you owned the house?_____

Number of Occupants/persons at this location: _____
Age of Occupants: _____

Permission to contact the current tenants? **Y/N**

How long have current tenants lived in the house (per unit, if multiple units)?_____
_____

If property is occupied by the owner and is a single-family house, skip to Question 3.

If property is a rental house, get contact information for tenants and contact them to answer Question 2.

Comments:
_____
_____
_____
_____
_____
_____
_____
_____
_____

2a. RENTER/OCCUPANT: [Note: for multi-tenant structures, please collect information for each address as possible] Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

2b. RENTER/OCCUPANT:
Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

2c. RENTER/OCCUPANT:
Interviewed: Y/N

Name: _____

Address:_____

Home Phone: _____ Office Phone: _____Cell Phone: _____

Preferred means and time(s) to contact:
_____In person _____Home Phone
_____Office Phone _____Cell Phone

How long have you lived there?_____ Number living at this location: _____
Age of Occupants: _____

3. RESIDENTIAL STRUCTURE CHARACTERISTICS

Residential type: (Circle appropriate responses)

Ranch	Multi-story	Multi-Family	
Raised Ranch	Apartment	Modular	Townhouse/Condo
Split Level	Mobile Home		

If structure includes multiple units, number of units: _____
Number of stories: _____
Comments:_____
Any historic use of structure:_____

If the property is also or has been used as a commercial establishment, what type?
Business Type(s) _____

4. RESIDENTIAL STRUCTURE CONSTRUCTION

House construction: wood frame concrete stone brick
Comments:_____

Year Constructed _____

Is there an attic: **Yes / No**
Is the attic occupied? **Yes / No** Comments_____

Is there a basement: **Yes / No**
Is the basement occupied? **Yes / No** Comments:_____
_____

Is there a crawl space: **Yes / No** Where located? _____
Construction: (Circle appropriate responses) Dirt Gravel Plastic lining Insulation

5. OCCUPANCY

Level	General Use of Each Floor (e.g., family room, bedroom, laundry, workshop)
Basement	_____
1st Floor	_____
2nd Floor	_____
3rd Floor	_____
4th Floor	_____

6. BASEMENT CHARACTERISTICS (circle all that apply)

a. Insulation: Describe: _____

b. Basement type: NA full partial unfinished partially finished finished
Comments: _____

c. Basement floor: concrete dirt stone
Comments: _____

d. Concrete floor: unsealed sealed carpet painted
Generally describe condition (e.g. cracks, damaged areas):_____
_____

e. Describe the condition of the basement floor: (circle any relevant key words that describe the response)
Good (no cracks or very minor cracking)
Fair (numerous small cracks, chips in several areas)
Poor (many cracks 1/8" or greater, heaved in areas)
Comments:_____

f. The condition of the basement is: (circle any relevant key words that describe the response)
Dry regardless of rainfall
Damp (feels humid, moisture evident on walls and floor, moldy, musty odor)
Leaks/Seeps (water enters only during heavy rain events)
Wet (small pools/puddles/streams of water most of the time, water seepage through floors and or walls)
Comments:_____

g. Most recent weather or sewer related flood event, if any _____
h. Sump present? **Yes / No** Location _____
i. Water in sump? **Yes / No** **NA**
j. Foundation walls: poured block stone other _____
k. Foundation walls: unsealed sealed/painted:_____

7. HEATING, VENTING and AIR CONDITIONING (circle all that apply)

Type of heating system(s) used in this building: (circle all that apply - note primary)

Hot air circulation	Heat pump	Hot water baseboard
Space Heaters	Steam radiation	Radiant floor
Electric baseboard	Wood stove/Fireplace	Outdoor wood boiler

Other_____

The primary type of fuel used is: Natural Gas Electric Fuel Oil Kerosene Propane Solar Wood Coal

Where is the hot water tank located? _____
Fueled by: _____

Where is the boiler/furnace located?: _____

Air conditioning: Central Air Window units None

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY
(Circle appropriate responses. Provide comments and or specify where response is "other")

a. Is there smoking in the residence? Yes / No

b. Has the residence ever had a fire? Yes / No
When/Cause_____

c. Is there a garage? Yes / No Attached Detached Outbuilding
Garage Use: _____
Outbuilding Use: _____

d. If an attached garage:
Is it heated? Yes / No NA
How heated? Furnace (Electric/Natural Gas) Stove (Wood/Pellets/Coal/Other)
Space Heater (Electric/Kerosene/Propane) Boiler (Natural Gas/Other)
Comments: _____
Are petroleum-powered machines or vehicles stored in it? (lawnmower, ATV, car)
Yes / No NA Comments_____
Has the attached garage had a fire? Yes / No NA
When/Cause_____

e. Is there a workshop or hobby craft area in the house or attached garage? Yes / No
Where_____
How used_____

f. Has there been any painting, furniture refinishing or staining in the house or attached garage in the past 6 months? Yes / No Where/When/Type (latex, oil, solvent)_____
_____

g. Has any new carpet, drapes or other textiles been installed in the past several months? Yes / No Where/When/Type_____

h. Do you have a kitchen exhaust fan? Yes / No If yes, where vented_____

i. Do you have bathroom exhaust fan(s)? Yes / No If yes, where vented (e.g. attic, outside)?_____

j. Do you have a clothes dryer? Yes / No If yes, where vented? _____

k. Have any pesticides been used at the house? Yes / No Describe:_____
_____

l. Do you notice any odors in the building? Yes / No Describe_____
_____

m. Do any of the building occupants use solvents at work? Yes / No
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, nail technician, hair stylist, other)

Types of solvents used/comments: _____
_____
If yes, are their clothes washed at work? Yes / No

n. Do any of the building occupants regularly use or work at a dry-cleaning service? (circle appropriate response)

No
Yes, use dry-cleaning regularly (weekly)
Yes, use dry-cleaning infrequently (monthly or less)
Yes, work at a dry-cleaning service

o. Is there a radon mitigation system built for the building structure? Yes / No
Date of Installation:_____
Is the system active or passive? Active/Passive
Comments:_____

p. Have cleaning products been used recently? Yes / No
When/Type_____

q. Have cosmetic products been used recently? Yes / No
When/Type_____

r. Do you regularly use air fresheners? Yes / No Describe where/type/frequency_____
_____

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well
Other:_____
If groundwater well, location and depth:_____

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well
Other:_____

10. PRODUCT INVENTORY – Request information concerning the types, quantities, and locations of household and other chemicals and petroleum-type products that may be located at the residence and document information, below. Additional information concerning chemical/product inventory is to be documented based upon on-site observations.

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size(units)	Condition[1]	Chemical Ingredients

Location	Product Description	Size(units)	Condition[1]	Chemical Ingredients

Notes: 1. Describe the condition of the containers as Closed (C), Open (O), new or used (N or U), or Deteriorated (D).

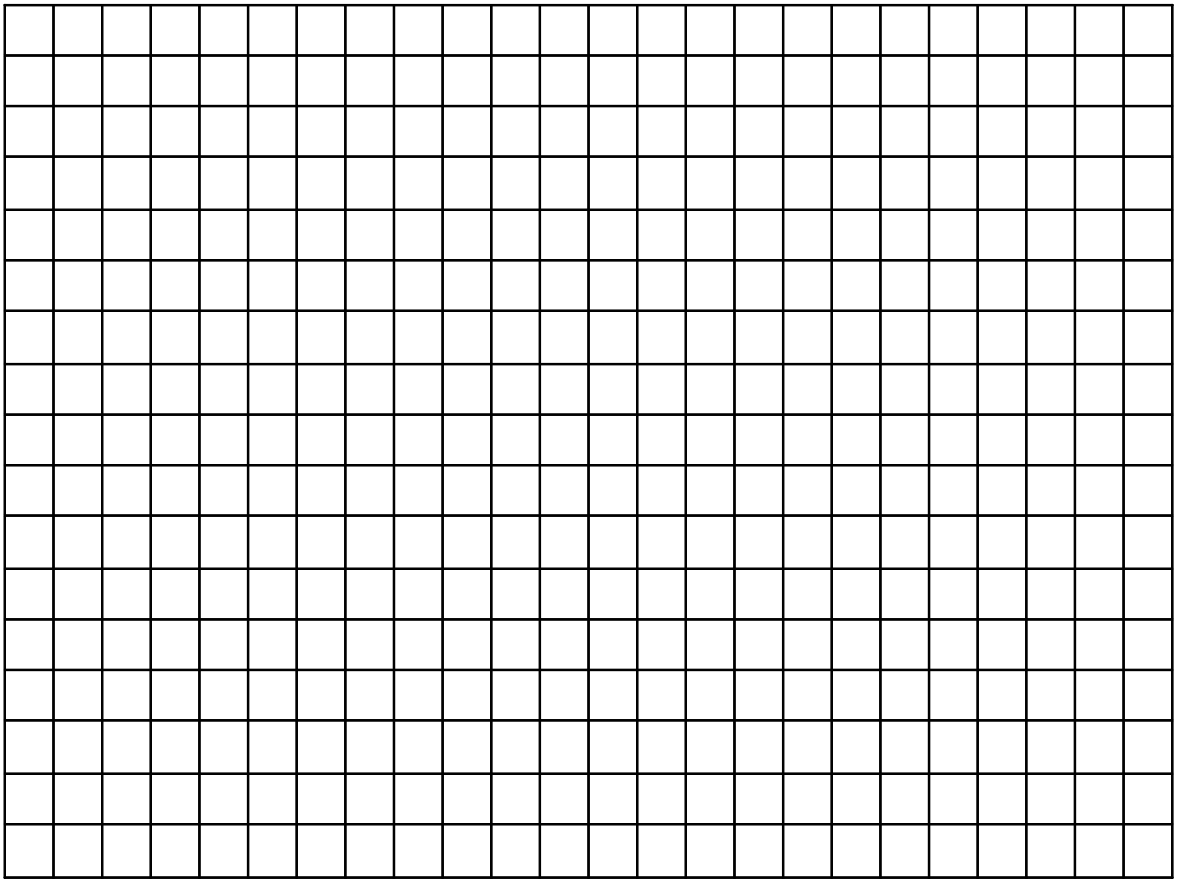
11. ADDITIONAL NOTES

12. FLOOR PLANS – TO BE COMPLETED ON-SITE, BY SAMPLING TEAM

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

BASEMENT:

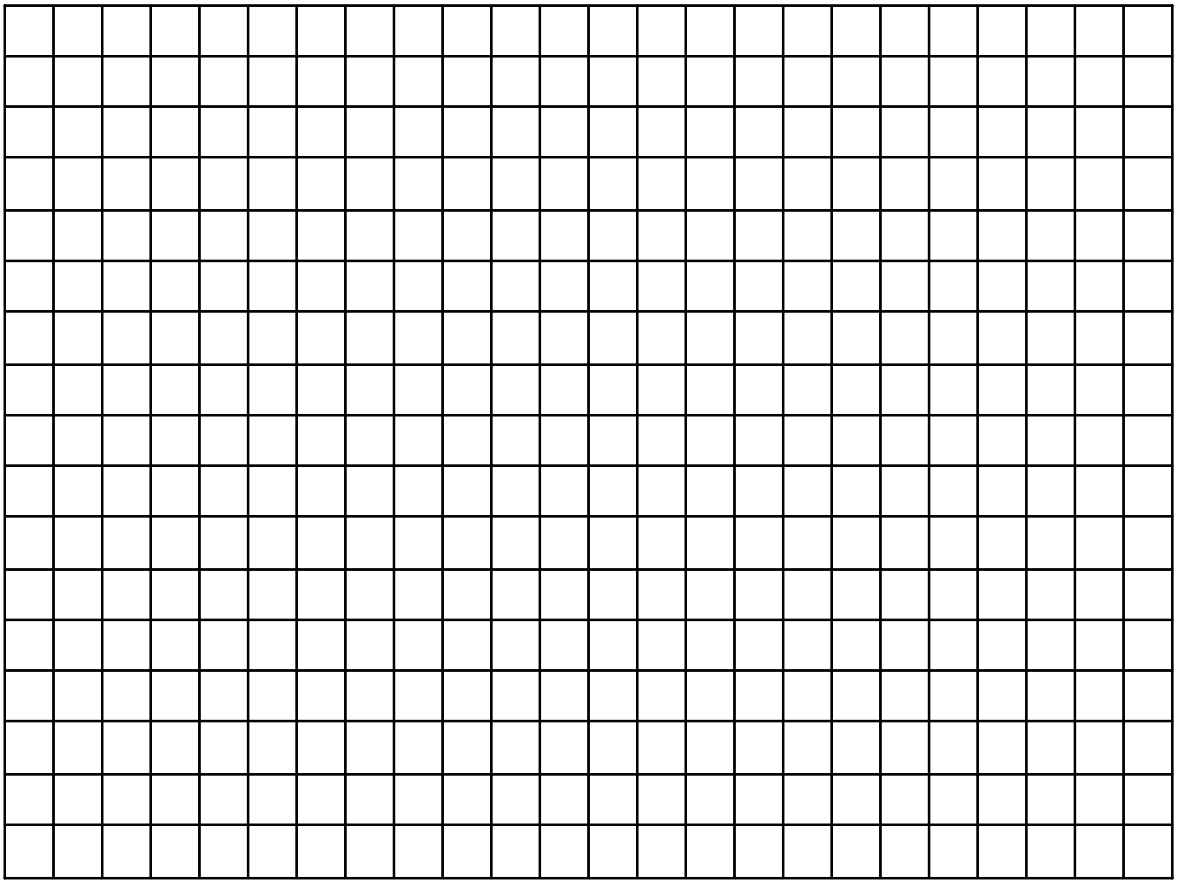
FIRST FLOOR:



13. OUTDOOR PLOT:

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system (if applicable), and a qualifying statement to help locate the site on a topographic map.



APPENDIX E

Examples of Community Outreach Documents and Access Agreement Forms

DELPHI

PERMISSION TO ENTER AND PERFORM SAMPLING

Property Address: _____

_____

I, _____, own the property specified above, and have the authority to provide access to it.

By my signature below, I hereby grant to Delphi Corporation, its contractor Haley & Aldrich, Inc., and the employees, contractors, agents and representatives of each company, permission to enter upon my property at the address specified above for the following purposes, to be performed at Delphi's expense:

- To collect one or more samples of indoor air, involving the use of one or more canisters to be left in place for a 24-hour period.
- To collect one or more samples of soil vapors from beneath the house by drilling a 1 to 2 inch wide hole in the basement floor.
- To collect one or more samples of outdoor air near your house over a 24-hour period.
- To photograph and otherwise document the sampling, both inside and outside the house.

Any disturbances to the property caused by the sampling, which we anticipate to be minor, will be repaired, including patching a concrete floor.

The results of testing performed at the house will be provided to you as soon as possible. Note that results will also be shared with the U.S. Environmental Protection Agency, the Ohio Department of Health and other governmental agencies as appropriate.

Property Owner Name (printed) _____

Property Owner Name (signature) _____ Date: _____

Phone Number (home) _____ (cell) _____

DELPHI

PERMISSION TO ENTER AND PERFORM SAMPLING

Property Address: _____

_____

I, _____, own the property specified above, and have the authority to provide access to it.

By my signature below, I hereby grant to Delphi Corporation, its contractor Haley & Aldrich, Inc., and the employees, contractors, agents and representatives of each company, permission to enter upon my property at the address specified above for the following purposes, to be performed at Delphi's expense:

- To collect one or more samples of indoor air, involving the use of one or more canisters to be left in place for a 24-hour period.
- To collect one or more samples of soil vapors from beneath the house by drilling a 1 to 2 inch wide hole in the basement floor.
- To collect one or more samples of outdoor air near this house over a 24-hour period.
- To photograph and otherwise document the sampling, both inside and outside the house.

Any disturbances to the property caused by the sampling, which we anticipate to be minor, will be repaired, including patching a concrete floor.

The results of testing performed at the house will be provided to you as soon as possible. Note that results will also be shared with the U.S. Environmental Protection Agency, the Ohio Department of Health and other governmental agencies as appropriate. Your signature below indicates that you have granted Delphi and its representatives permission to contact your tenants to coordinate sampling.

Property Owner Name (printed) _____

Property Owner Name (signature) _____ Date: _____

Property Owner Phone Number (home) _____ (cell) _____

Tenant Name(s) _____ (phone) _____

DELPHI

DECLINATION STATEMENT

Property Address: _____

_____

I, _____, own the property specified above (the "Property"), and have the authority to provide access to it.

I have reviewed and understand the document entitled Permission to Enter and Perform Sampling (attached) provided to me by Delphi Corporation. My signature on this Declination Statement indicates that I **decline** to grant Delphi and its agents, representatives, employees, contractors and subcontractors permission to access the Property for the purpose of environmental testing and/or installing, operating, maintaining and removing as necessary environmental testing, recovery and treatment systems at the Property.

By signing this document, I indicate that I understand that Delphi and its representatives bear no obligation for making this offer to me again at any time in the future.

Property Owner Name (printed) _____

Property Owner Name (signature) _____ Date: _____

DELPHI

February 7, 2008

[redacted]

Dear [redacted]:

As you are now aware, Delphi has been conducting an environmental study at its Home Avenue facility and in the adjacent neighborhood. After consultation with the U.S. Environmental Protection Agency (U.S. EPA) and as a next step in this study, Delphi would like to collect air samples inside and under your house located at [redacted] Ex. 6 P... Names, Addresses an... . This testing is important to determine if there is any current impact to indoor air quality at this house related to past operations at the Delphi plant. With your permission, this testing will be done at no cost to you, and at your convenience.

Trained sampling personnel will collect three different samples in metal canisters:

- An indoor air sample will be collected from your basement over a 24-hour period.
- A sample of the air within the soil (soil vapor) from beneath your basement will be taken by drilling a small hole in the basement floor. This is also a 24-hour sample.
- A sample of the outdoor air will be collected near your house over a 24-hour period.

You and/or your tenants may remain in the house while the testing takes place. The sampling team will return the next day to collect the canisters and will, at no cost to you, repair any minor disturbances, such as patching concrete.

Additional information about vapor intrusion and the sampling equipment can be found in the enclosed documents.

Delphi and the U.S. EPA will notify you of your test results and will also share the results with the Ohio Department of Health and other governmental agencies as appropriate.

Delphi, the U.S. EPA, the Ohio Department of Health, and the Southwest Priority Board believe this testing is very important, and will greatly appreciate your cooperation to help us complete this effort.

If you are agreeable to the testing, please complete the attached "Permission to Enter and Perform Sampling" form and return it inside the enclosed pre-addressed, stamped envelope as soon as possible, as Delphi would like to conduct the testing in February or early March. A Delphi representative will contact you upon receiving your completed form to schedule the testing.

If you have any questions about the testing or completing the form, you can contact Delphi toll-free at 1-866-4-DELPHI (1-866-433-5744).

More than a dozen of your neighbors have already had this testing conducted at their property. We hope you will join them by returning the completed form today!

Sincerely,

Thomas C. Woods
Regional Director,
Government & Community Relations

Enclosures

Bureau of
Environmental Health
Health Assessment Section
"To protect and improve the health of all Ohioans"

Chloroform

Answers to Frequently Asked Health Questions

What is chloroform?

Chloroform, also called trichloromethane or methyltrichloride, is a colorless liquid with a pleasant, non-irritating odor and a slightly sweet taste. As a volatile organic compound (VOC), chloroform easily vaporizes (turns into a gas) in the air. Chloroform does not easily burn, but it will burn when it reaches very high temperatures. Chloroform was one of the first inhaled anesthetics to be used during surgery, but it is not used as an anesthesia today.

Where do you find chloroform?

In order to destroy the harmful bacteria found in our drinking water and waste waters, the chemical chlorine is added to these water sources. As a by-product of adding chlorine to our drinking and waste waters, small amounts of chloroform are formed. So small amounts of chloroform are likely to be found almost everywhere.

In industry, nearly all the chloroform made in the U.S. is used to make other chemicals. From the factories that make or use this chemical, chloroform can enter the air directly or it can enter the air from the evaporation (changing from liquid to a gas) of chloroform-contaminated waters and soils. Chloroform can also enter the water and soils from industry storage and waste sites spills and leaks.

Not only does chloroform evaporate very quickly when exposed to air, it also dissolves easily in water and does not stick to the soils very well. This means chloroform can easily travel through the soils to groundwater, where it can enter a water supply. Chloroform lasts a long time in both the air and in groundwater. Most of the chloroform in the air eventually breaks down, but it is a slow process. Chloroform does not appear to build up in great amounts in plants and animals, but we may find some small amounts of chloroform in foods.

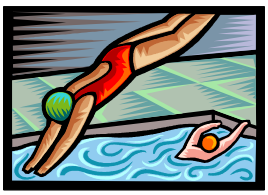
How do you come in contact with chloroform? Who is more at risk?

You are most likely to be exposed to chloroform by drinking contaminated water and/or by breathing contaminated indoor or outdoor air. Chloroform is found in nearly all public drinking water supplies. Chloroform is also found in the air from all areas of the United States. You are probably exposed to small amounts of chloroform in your drinking water and/or in beverages that are made using water that contains chloroform.

People who are at greater risk to be exposed to chloroform at higher-than-normal levels are people who work at or near chemical plants and factories that make or use chloroform. Higher exposures might occur in workers at drinking water treatment plants, waste water treatment plants, and paper and pulp mills. People who operate waste-burning equipment may also be exposed to higher than normal levels. People who swim a lot in swimming pools may also be exposed to higher levels.

How does chloroform enter and leave your body?

- Chloroform can enter your body if you breathe contaminated air (inhalation)
- Chloroform can enter your body if you eat/drink contaminated food or water (ingestion)
- Chloroform can also enter your body through the skin (dermal).



If you take a bath, shower or swim in a pool with chloroform-contaminated water, it can enter your body through inhalation and dermal contact.

Studies in humans and animals show that after you breathe contaminated air or eat contaminated food, the chloroform can quickly enter your bloodstream from your lungs and intestines. Inside your body, chloroform is carried by the blood to all parts of your body, such as the liver, kidneys and fat cells.

Some of the chloroform that enters your body leaves unchanged in the air you breathe out and some of it is broken down into other chemicals. These chemicals are known as breakdown products or metabolites, and some of them can attach to other chemicals inside the cells of your body and may cause harmful effects if they collect in high enough amounts in your body. Some of the metabolites will leave the body in the air you breathe out and small amounts of the breakdown products leave the body in the urine and stool.

How does chloroform affect health?

In humans, large amounts of chloroform can affect the central nervous system (brain), liver and kidneys. Breathing high levels for a short time can cause fatigue, dizziness, and headache. If you breathe air, eat food, or drink water containing elevated levels of chloroform, over a long period, the chloroform may damage your liver and kidneys. Large amounts of chloroform can cause sores (lesions) when the chloroform touches your skin.

Lab studies have shown chloroform caused reproductive problems in animals (mice and rats). However, there is no evidence that show whether chloroform causes harmful reproductive effects or birth defects in humans.

Does chloroform cause cancer?

Based on animal studies, the Department of Health and Human Services (DHHS) has determined that chloroform may reasonably be anticipated to be a carcinogen (a substance that causes cancer). The International Agency for Research on Cancer (IARC) has determined that chloroform is possibly carcinogenic to humans (2B). The EPA has also determined that chloroform is a "probable" human carcinogen.

Results of studies of people who drank chlorinated water showed a possible link between the chloroform in the chlorinated water and the occurrence of cancer of the colon and urinary bladder. Rats and mice that ate food or drank water that had large amounts of chloroform in it for a long period of time developed cancer of the liver and kidneys. However, there is no evidence that shows whether chloroform causes liver and kidney cancer in humans.

Is there a medical test to show whether you have been exposed to chloroform?

Although we can measure the amount of chloroform in the air you breathe out and in blood, urine, and body tissues, we have no reliable test to determine how much chloroform you have been exposed to or whether you will experience any harmful health effects.

The measurement of chloroform in body fluids and tissues may help to determine if you have come into contact with large amounts of chloroform. However, these tests are useful only a short time after you are exposed to chloroform because it leaves the body quickly.

What has been done to protect human health?

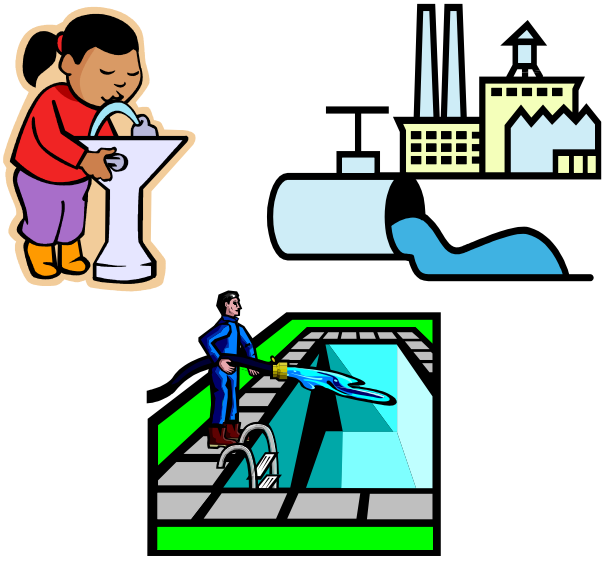
The amount of chloroform normally expected to be in the air ranges from 0.02 to 0.05 parts of chloroform per billion parts (ppb) of air and from 2 to 44 ppb in treated drinking water.

Notes: The below unit of measurement will be found in the ppb (parts per billion) range. Examples: One part per billion (1 ppb) would be equal to having one bean in a pile of one billion beans, or one ppb would be equal to one second of time in 32 years.

The Environmental Protection Agency (EPA) has set the level of chloroform in drinking water at 80 ppb.

The Occupational Safety and Health Administration (OSHA) has set a permissible 50,000 ppb exposure limit of air in the workplace during an 8-hour workday, 40-hour week.

The EPA requires chloroform spills or accidental releases into the environment of 10 pounds or more of be reported to the EPA.



For more information contact:

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Fax: (614) 466-4556

Reference:

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for chloroform. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

The Ohio Department of Health is in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health and Human Services.

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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Created 04/10/07

Bureau of Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans"

Exposure to Toxic Chemicals

Answers to Frequently Asked Health Questions

How are we exposed to chemicals?

We come in contact with many different chemicals every day that are non-toxic and normally do not cause health problems. But any chemical could become toxic if a person comes in contact with high enough doses. For example: Aspirin will cure a headache but too much aspirin becomes toxic and can cause serious health problems. You can get sick from contact with chemicals but getting sick will depend on the following:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle
  Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

Other factors that increase health risks are:

- Current health status (if you are ill or healthy).
- Lifestyle, age, and weight.
- Smoking, drinking alcohol, or taking certain medicines or drugs.
- Allergies to certain chemicals.
- Past chemical exposure.
- Working in an industry/factory that makes or uses chemicals.

What is a completed exposure pathway?

Chemicals must have a way to get into a person's body to cause health problems. This process of those chemicals getting into our bodies is called an exposure pathway. A completed exposure pathway includes all of the following 5 links between a chemical source and the people who are exposed to that chemical.

(1) A Source of the chemical (where the chemical came from);
(2) Environmental Transport (the way the chemical moves from the source to the public. This can take place through the soil, air, underground drinking water or surface water);
(3) Point of Exposure (the place where there is physical contact with the chemical. This could be on-site as well as off-site);
(4) A Route of Exposure (how people came into the physical contact with the chemical. This can take place by drinking, eating, breathing or touching it);
(5) People Who Could be Exposed (people that live near a facility who are most likely to come into physical contact with the site-related chemical).

What are exposure routes?

There are three ways (routes) a person can come in contact with toxic chemicals. They include:

- Breathing (inhalation).
- Eating and drinking (ingestion).
- Skin contact (dermal contact).

Inhalation (breathing)
Chemicals can enter our body through the air we breathe. These chemicals can come in the form of dust, mist, or fumes. Some chemicals may stay in the lungs and damage lung cells. Other chemicals may pass through lung tissue, enter the bloodstream, and affect other parts of our body.

Ingestion (eating or drinking)
The body can absorb chemicals in the stomach from the foods we eat or the liquids we drink. Chemicals may also be in the dust or soil we swallow. These chemicals can enter our blood and affect other parts of our body.

Dermal (skin) Contact
Chemicals can enter our body through our skin. We can come in contact with water polluted by chemicals or touch polluted soil. Some chemicals pass through our skin and enter our bloodstream, affecting other parts of our body.

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Tetrachloroethylene (PCE)

Other names for tetrachloroethylene include PCE, perchloroethylene, PERC or tetrachloroethene.

What is PCE?

Tetrachloroethylene (also known as PCE, PERC or perchloroethylene) is a man-made chemical that is widely used for dry cleaning clothes and degreasing metal. It is also used to make other chemicals and can be found in some household products such as water repellents, silicone lubricants, spot removers, adhesives and wood cleaners. It easily evaporates (turn from a liquid to a gas) into the air and has a sharp, sweet odor. PCE is a nonflammable (does not burn) liquid at room temperature.

How does PCE get into the environment?

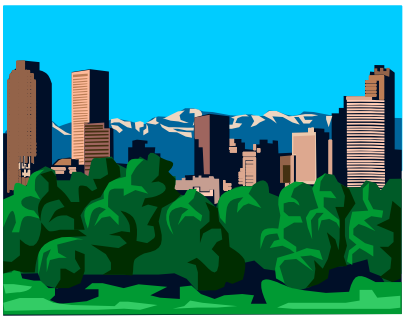
PCE can evaporate into the air during dry cleaning operations and during industrial use. It can also evaporate into the air if it is not properly stored or was spilled. If it was spilled or leaked on the ground, it may find its way into groundwater (underground drinking water).

People can be exposed to PCE from the environment from household products, from dry cleaning products and from their occupation (work). Common environmental levels of PCE (called background levels) can be found in the air we breathe, in the water we drink and in the food we eat. In general, levels in the air are higher in the cities or around industrial areas where it is used more than rural or remote areas.

The people with the greatest chance of exposure to PCE are those who work with it. According to estimates from a survey conducted by the National Institute for Occupational Safety and Health (NIOSH), more than 650,000 U.S. workers may be exposed. However, the air close to dry cleaning business and industrial sites may have levels of PCE higher than background levels. If the dry cleaning business or industry has spilled or leaked PCE on the ground, there may also be contaminated groundwater as well.

What happens to PCE in the environment?

Much of the PCE that gets into surface waters or soil evaporates into the air. However, some of the PCE may make its way to the groundwater. Microorganisms can break down some of the PCE in soil or underground water. In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain. PCE does not appear to collect in fish or other animals that live in water.



How can PCE enter and leave my body?

PCE can enter your body when you breathe contaminated air or when you drink water or eat food contaminated with the chemical. If PCE is trapped against your skin, a small amount of it can pass through into your body. Very little PCE in the air can pass through your skin into your body. Breathing contaminated air and drinking water are the two most likely ways people will be exposed to PCE. How much enters your body depends on how much of the chemical is in the air, how fast and deeply you are breathing, how long you are exposed to it or how much of the chemical you eat or drink.

Most PCE leaves your body from your lungs when you breathe out. This is true whether you take in the chemical by breathing, drinking, eating, or touching it. A small amount is changed by your body (in your liver) into other chemicals that are removed from your body in urine. Most of the changed PCE leaves your body in a few days. Some of it that you take in is found in your blood and other tissues, especially body fat. Part of the PCE that is stored in fat may stay in your body for several days or weeks before it is eliminated.

Can PCE make you sick?

Yes, you can get sick from contact with PCE. But getting sick will depend upon:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

How can PCE affect my health?

Exposure to very high concentrations of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness and even death. Skin irritation may result from repeated or extended contact with it as well. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used PCE to get a "high." Normal background levels (or common environmental levels) will not cause these health affects.

Does PCE cause cancer (carcinogen)?

In the United States, the National Toxicology Program (NTP) releases the *Report on Carcinogens* (RoC) every two years. The *Report on Carcinogens* (RoC) identifies two groups of agents: "Known to be human carcinogens" & "Reasonably anticipated to be human carcinogens."

PCE has been shown to cause liver tumors in mice and kidney tumors in male rats. There is limited evidence for the carcinogenicity of PCE in humans. PCE has been studied by observing laundry and dry-cleaning workers, who may also have been exposed to other solvents, especially trichloroethylene (TCE), but also petroleum solvents.

The *Eleventh Report on Carcinogens* (RoC) has determined that PCE may reasonably be anticipated to be a carcinogen.

Reference:

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for tetrachloroethylene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service

Report on Carcinogens, Eleventh Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, 2006. http://ntp.niehs.nih.gov/ntp/roc/toc11.html

Is there a medical test to show whether you have been exposed to PCE?

One way of testing for PCE exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood. Because PCE is stored in the body's fat and slowly released into the bloodstream, it can be detected in the breath for weeks following a heavy exposure. Also, PCE and trichloroacetic acid (TCA), a breakdown product of PCE, can be detected in the blood. These tests are relatively simple to perform but are not available at most doctors' offices and must be done at special laboratories that have the right equipment. Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to PCE or the other chemicals that produce the same breakdown chemicals.

What has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of PCE that can be in drinking water is 0.005 milligrams PCE per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) have set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that PCE be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

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ATSDR AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

OHIO DEPARTMENT OF HEALTH ODH

Revised 08-21-06

Bureau of Environmental Health
Health Assessment Section
"To protect and improve the health of all Ohioans

Trichloroethylene (TCE)

(try- klor'oh eth'uh- leen)

Answers to Frequently Asked Health Questions

What is TCE?

TCE is man-made chemical that is not found naturally in the environment. TCE is a non-flammable (does not burn), colorless liquid with a somewhat sweet odor and has a sweet, "burning" taste. It is mainly used as a cleaner to remove grease from metal parts. TCE can also be found in glues, paint removers, typewriter correction fluids and spot removers.

The biggest source of TCE in the environment comes from evaporation (changing from a liquid into a vapor/gas) when industries use TCE to remove grease from metals. But TCE also enters the air when we use common household products that contain TCE. It can also enter the soil and water as the result of spills or improper disposal.

What happens to TCE in the environment?

- TCE will quickly evaporate from the surface waters of rivers, lakes, streams, creeks and puddles.
- If TCE is spilled on the ground, some of it will evaporate and some of it may leak down into the ground. When it rains, TCE can sink through the soils and into the ground (underground drinking) water.
- When TCE is in an oxygen-poor environment and with time, it will break down into different chemicals such as 1,2 Dichloroethene and Vinyl Chloride.
- TCE does not build up in plants and animals.
- The TCE found in foods is believed to come from TCE contaminated water used in food processing or from food processing equipment cleaned with TCE.

How does TCE get into your body?

- TCE can get into your body by breathing (inhalation) air that is polluted with TCE vapors. The vapors can be produced from the manufacturing of TCE, from TCE polluted water evaporating in the shower or by using household products such as spot removers and typewriter correction fluid.
- TCE can get into your body by drinking (ingestion) TCE polluted water.
- Small amounts of TCE can get into your body through skin (dermal) contact. This can take place when using TCE as a cleaner to remove grease from metal parts or by contact with TCE polluted soils.

Can TCE make you sick?

Yes, you can get sick from TCE. But getting sick will depend on the following:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

How does TCE affect your health?

Breathing (Inhalation):

- Breathing high levels of TCE may cause headaches, lung irritation, dizziness, poor coordination (clumsy) and difficulty concentrating.
- Breathing very high levels of TCE for long periods may cause nerve, kidney and liver damage.

Drinking (Ingestion):

- Drinking high concentrations of TCE in the water for long periods may cause liver and kidney damage, harm immune system functions and damage fetal development in pregnant women (although the extent of some of these effects is not yet clear).
- It is uncertain whether drinking low levels of TCE will lead to adverse health effects.

Skin (Dermal) Contact:

- Short periods of skin contact with high levels of TCE may cause skin rashes.

Does TCE cause cancer?

The National Toxicology Program's 11th Report on Carcinogens places chemicals into one of two cancer-causing categories: *Known to be Human Carcinogens* and *Reasonably Anticipated to be Human Carcinogens*.

The11th Report on Carcinogens states TCE is *"Reasonably Anticipated to be Human Carcinogen."*

The category *"Reasonably Anticipated to be Human Carcinogen"* gathers evidence mainly from animal studies. There may be limited human studies or there may be no human or animal study evidence to support carcinogenicity; but the agent, substance or mixture belongs to a well-defined class of substances that are known to be carcinogenic.

There are human studies of communities that were exposed to high levels of TCE in drinking water and they have found evidence of increased leukemia's. But the residents of these communities were also exposed to other solvents and may have had other risk factors associated with this type of cancer.

Animal lab studies in mice and rats have suggested that high levels of TCE may cause liver, lung, kidney and blood (lymphoma) cancers.

As part of the National Exposure Subregistry, the Agency for Toxic Substances and Disease Registry (ATSDR) compiled data on 4,280 residents of three states (Michigan, Illinois, and Indiana) who had environmental exposure to TCE. ATSDR found no definitive evidence for an excess of cancers from these TCE exposures.

The U.S. EPA is currently reviewing the carcinogenicity of TCE.

Is there a medical test to show whether you have been exposed to TCE?

If you have recently been exposed to TCE, it can be detected in your breath, blood, or urine. The breath test, if done soon after exposure, can tell if you have been exposed to even a small amount of TCE.

Exposure to larger amounts is measured in blood and urine tests. These tests detect TCE and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products in the blood and urine so the detection of the breakdown products is not absolute proof of exposure to TCE.

These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment. **Note:** Tests can determine if you have been exposed to TCE but cannot predict if you will experience adverse health effects from the exposure.

Has the federal government made recommendations to protect human health?

The federal government develops regulations and recommendations to protect public health and these regulations can be enforced by law.

Recommendations and regulations are periodically updated as more information becomes available. Some regulations and recommendations for TCE follow:

- The Environmental Protection Agency (EPA) has set a maximum contaminant level for TCE in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water (5 ppb).
- The Occupational Safety and Health Administration (OSHA) have set an exposure limit of 100 ppm (or 100 parts of TCE per million parts of air) for an 8-hour workday, 40-hour workweek.
- The EPA has developed regulations for the handling and disposal of TCE.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for TCE (electronic at **http://www.atsdr.cdc.gov/tfacts19.html**)

Report on Carcinogens, Eleventh Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, 2005 (2005 electronic at **http://ntp.niehs.nih.gov/ntp/roc/toc11.html**)

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Health Assessment Section

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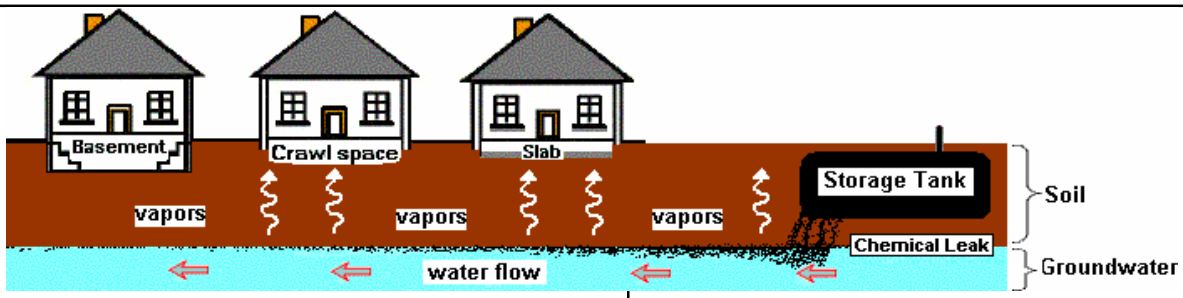
Vapor Intrusion

Answers to Frequently Asked Health Questions



What is vapor intrusion?

Vapor intrusion refers to the vapors produced by a chemical spill/leak that make their way into indoor air. When chemicals are spilled on the ground or leak from an underground storage tank, they will seep into the soils and will sometimes make their way into the groundwater (underground drinking water). There are a group of chemicals called volatile organic compounds (VOCs) that easily produce vapors. These vapors can travel through soils, especially if the soils are sandy and loose or have a lot of cracks (fissures). These vapors can then enter a home through cracks in the foundation or into a basement with a dirt floor or concrete slab.

VOCs and vapors:

VOCs can be found in petroleum products such as gasoline or diesel fuels, in solvents used for industrial cleaning and are also used in dry cleaning. If there is a large spill or leak resulting in soil or groundwater contamination, vapor intrusion may be possible and should be considered a potential public health concern that may require further investigation.

Although large spills or leaks are a public health concern, other sources of VOCs are found in everyday household products and are a more common source of poor indoor air quality. Common products such as paint, paint strippers and thinners, hobby supplies (glues), solvents, stored fuels (gasoline or home heating fuel), aerosol sprays, new carpeting or furniture, cigarette smoke, moth balls, air fresheners and dry-cleaned clothing all contain VOCs.

Can you get sick from vapor intrusion?

You can get sick from breathing harmful chemical vapors. But getting sick will depend on:
How much you were exposed to (dose).
How long you were exposed (duration).
How often you were exposed (frequency).
How toxic the spill/leak chemicals are.
General Health, age, lifestyle: Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

VOC vapors at high levels can cause a strong petroleum or solvent odor and some persons may experience eye and respiratory irritation, headache and/or nausea (upset stomach). These symptoms are usually temporary and go away when the person is moved to fresh air.

Lower levels of vapors may go unnoticed and a person may feel no health effects. A few individual VOCs are known carcinogens (cause cancer). Health officials are concerned with low-level chemical exposures that happen over many years and may raise a person's lifetime risk for developing cancer.

How is vapor intrusion investigated?

In most cases, collecting soil gas or groundwater samples near the spill site is done first to see if there is on-site contamination. If soil vapors or groundwater contamination are detected at a spill site, environmental protection and public health officials may then ask that soil vapor samples be taken from areas outside the immediate spill site and near any potential affected business or home. The Ohio Department of Health (ODH) does not usually recommend indoor air sampling for vapor intrusion before the on-site contamination is determined.

(continued on next page)

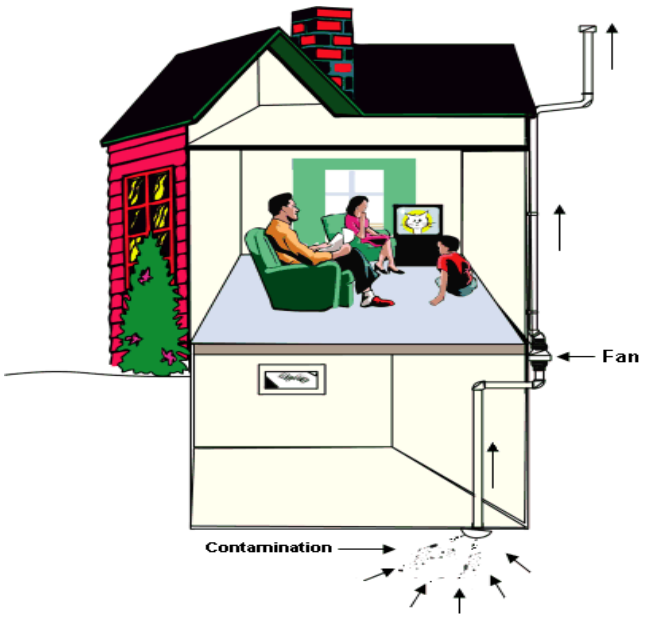
How is vapor intrusion investigated? (continued)

Because a variety of VOC sources are present in most homes, testing will not necessarily confirm VOCs in the indoor air are from VOC contamination in soils at nearby spill site. But if additional sampling is recommended, samples may be taken from beneath the home's foundation (called sub-slab samples), to see if vapors have reached the home. Sub-slab samples are more reliable than indoor air samples and are not as affected by other indoor chemical sources. If there was a need for additional sampling on a private property, homeowners would be contacted by the cleanup contractor or others working on the cleanup site and their cooperation and consent would be requested before any testing/sampling would be done.

What happens if a vapor intrusion problem is found?

If vapor intrusion is having an effect on the air in your home, the most common solution is to install a *radon mitigation system*. A radon mitigation system will prevent gases in the soil from entering the home. A low amount of suction is applied below the foundation and the vapors are vented to the outside. The system uses minimal electricity and should not noticeably affect heating and cooling efficiency. This mitigation system also prevents radon from entering the home, an added health benefit. Usually, the party responsible for cleaning up the contamination is also responsible for paying for the installation of this system. Once the contamination is cleaned up, the system should no longer be needed. In homes with on going radon problems, ODH suggests these systems remain in place permanently.

Radon Mitigation System



What can you do to improve your indoor air quality?

As stated before, the most likely source of VOCs in indoor air comes from the common items that are found in most homes. The following helpful hints will help improve air quality inside your home:

- Do not buy more chemicals than you need and know what products contain VOCs.
- If you have a garage or an out building such as a shed, place the properly stored VOC-containing chemicals outside and away from your family living areas.
- Immediately clean and ventilate any VOC spill area.
- If you smoke, go outside and/or open the windows to ventilate the second-hand, VOC-containing smoke outdoors.
- Make sure all your major appliances and fireplace(s) are in good condition and not leaking harmful VOC vapors. Fix all appliance and fireplace leaks promptly, as well as other leaks that cause moisture problems that encourage mold growth.
- Most VOCs are a fire hazard. Make sure these chemicals are stored in appropriate containers and in a well-ventilated location and away from an open pilot light (flame) of a gas water heater or furnace.
- Fresh air will help prevent both build up of chemical vapors in the air and mold growth. Occasionally open the windows and doors and ventilate.
- Test your home for radon and install a radon detector.

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APPENDIX F

Example of Data Management Spreadsheet

Appendix F
Example of Data Management Table
Delphi VOC Plume Site
Indoor Air Sampling and Mitigation

EPA ID	Property Address	Property Owner	Comments	Owner's Phone Number	Rental	Tenant Contact	Tenant Phone Number	Baseline Acess Agreement Signed (date)	Baseline Sub-Slab Sample Result (ppbV)					Baseline Indoor Air Sample Result (ppbV)					Recommended Course of Action	Phase I Access Agreement Signed	SSD Evaluation Conducted
									Sample Date	Sample ID	CHLOROFORM	TCE	PCE	Sample Date	Sample ID	CHLOROFORM	TCE	PCE			
EPA-01									5/3/2007	EPA-01-SS	ND (1.6)	ND (1.6)	2.1	NA	NA	NA	NA	NA	NFA	NA	NA
EPA-02									5/5/2007	EPA-02-SS	NA	NA	NA	6/6/2007	EPA-02-IA	ND (0.20)	0.75	2.7	Mitigation	Pending	
EPA_03									6/19/2007	EPA-03-SS	7.1	182	110	7/19/2007	EPA-03-IA	ND (0.20)	ND (0.20)	1.3	Quarterly Monitoring	10/3/2007	NA

KEY	
NA	Not applicable
ND	Not detected
PCE	Tetrachloroethene
TCE	Trichloroethene
NFA	No Further Action
	Sample result is pending
182	Sample result exceeds ODH recommended health-based screening level[1]
	Sample collected by U.S. EPA
	Sample collected by Delphi
	Mitigation Monitoring
	Quarterly Sampling

All results and screening/action levels are displayed in parts per billion by volume (ppbv)

(0.23) Number in parenthesis indicates laboratory's analytical method reporting limit (MRL)

Indoor Air and Sub-slab Soil Vapor ODH-recommended Screening Levels for VOCs in Residential Structures[1] (parts per billion by volume)

Chemical Name	ATSDR[2] Indoor Air Short-Term Action Level	Indoor Air Long-Term Screening Level[3]	Sub-slab Soil Vapor Screening Level[3]
TCE	100	0.4	4
PCE	200	12	120
Chloroform	50	2.2	22

1. Established in correspondence from Ohio Department of Health (June 4, 2007)

2. ATSDR = Agency for Toxic Substances Disease Registry

3. From U.S. EPA Draft Vapor Intrusion Guidance (2002)